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THE INTERNAL STRUCTURE OF WOOL.

ITS SIGNIFICANCE FOR SHEEP-BREEDERS.

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DURING the past year the view has been expressed by certain English wool-spinners that the quality of those New Zealand wools that are dominantly of a Romney character are deteriorating in quality. If such were the case it would be of very considerable significance to our wool industry, as the Romney is numerically our most important sheep, and Romney and Romney-cross wools constitute the major portion of our annual clip. It was therefore decided to carry out some investigations into the structure of New Zealand wools in general and that of Romney wool in particular. The object was to ascertain if possible what were the actual structural defects in the fibres that were apparently causing some at least of our wool to be held in low esteem by overseas manufacturers, and whether such defects were confined to the Romney or were also present in other breeds. In connection with this investigation, which so far has been confined to the actual internal and external structure of the wool-fibre itself, I have to express my very great thanks for assistance rendered me by Professor Cossar-Ewart, of Edinburgh, during his visit to New Zealand last year, and by Mr. William Perry, the well-known Romney breeder, whose practical advice has been invaluable.

Right from the commencement of the investigation it was recognized that in the wool trade there are a large number of terms in regular use, all of which are connected with peculiarities of structure.

Among such terms are "character," "crimp," "harshness," "softness," "free-handling," "quality," "lustre," and "tip." These terms are well known and used by sheep-breeders. The actual structural peculiarities of the individual fibres that lead to variation in the wool characteristics of the fleece and have given rise to all these terms are, however, comparatively very little known. As it is the actual structure of the fibres themselves that determine whether a wool is harsh or soft, free-handling or the reverse, it is clearly advisable to learn all that is possible about the structure of New Zealand wools, and for wool-growers to eliminate as far as possible those structural defects that are likely to lead to deterioration in quality.

Before dealing with certain phases of the structure of wool it is necessary to state just what wool is, and in what respects it differs from other animal-fibres. There are three great types of animal-fibres used for clothing and other domestic purposes—namely, hair, wool, and fur. Much speculation has been pursued in the past as to whether these three types of fibres have been evolved from a single stock, or whether they each represent structures in no way related to each other. When typical hair, wool, and fur are compared together they show many outstanding differences; on the other hand, there are many animal-fibres that possess the essential characters of both hair and wool, and of hair, wool, and fur, so that it is often difficult to draw any hard-and-fast line of distinction between any of these groups.

A typical hair consists of a central strand of rather spongy thin-walled cells surrounded by a mass of closely packed fusiform cells, which in turn are jacketed with a single layer of flattened cells, the edges of which are closely pressed together, presenting a perfectly smooth and uniform surface. The central strand is termed the "pith" or "medulla." The tissue surrounding the medulla is termed the "cortex," and the cells composing the outer layer are termed the "scales."

A fur-fibre possesses all these three types of tissue, but the medulla is generally even more developed than in ordinary hair, and the scales, instead of being closely pressed together, often have their upper edges quite free and stand out slightly from the surface of the fibre. In true wool the medulla or central strand is or should be absent, the whole of the tissue, with the exception of the enveloping scales, consisting of cortex material. The scales, again, are very characteristic, the upper portion of each one being free, and turning slightly outwards, allowing an easy entrance and exit of materials to and from the cortical tissue. This gives the fibre a serrated appearance, and very frequently the word "serration" is used to express this peculiarity, the term being in reality synonymous with "scale." Not infrequently "serration" is used to express crimp or curl, but the use of the word in this connection is quite incorrect. Another very important characteristic of animal-fibres is whether they will felt or not. In this respect true hair belongs to the class of non-felting fibres, while both fur and wool can be felted. At one time it was considered that the serrated exterior of the wool and fur fibre was the actual cause of felting taking place, but since it has been shown that certain serrated fibres will not felt, and certain non-serrated ones felt readily, doubts on the validity of this theory have been expressed.

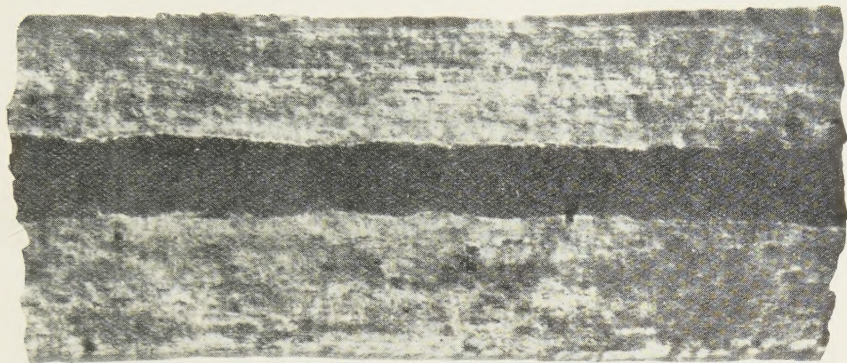


FIG. 1. HAIR, SHOWING CENTRAL STRAND AS MEDULLA. MAGNIFIED 400 DIAMETERS.

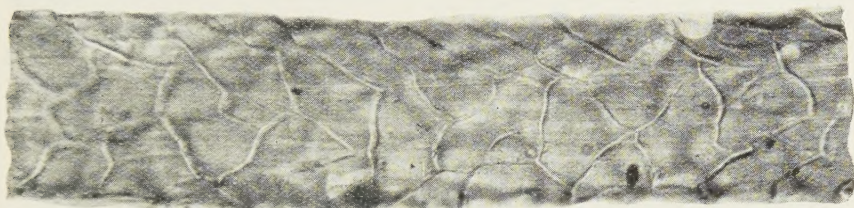


FIG. 2. WOOL-FIBRE, SHOWING NO MEDULLA AND OUTER SCALES. $\times 400$.

[Microphotos by Biological Laboratory.]

From what has been written it can be seen to be difficult to exactly define wool from other animal-fibres. If one takes felting-property as a criterion, this falls to the ground, as both fur and certain hair possess this characteristic. The presence of serration is not confined to wool, being regular in many furs. The absence of a medulla or central strand is perhaps the best single criterion as to whether a fibre is wool or not, but here, again, if this were rigidly interpreted many apparently true wools would have to be classed as hair.

The fact that there is no single structural feature that always distinguishes wool from either hair or fur, and no feature always distinguishing fur from hair, rather indicates that both wool and fur represent modified hair, and have been gradually evolved from hair in the distant ages of the past. A very regular feature of many wild animals is the production of a double coat of fibres, one much longer than the other and typically hairlike in character, and the other an undergrowth of much finer fibres possessing many wool characteristics. In primitive sheep this feature is quite regular, and even in such a breed as the Merino the new-born lamb possesses a more or less double coat of hair and wool. Again, many species of goats that are supposed to produce only hair have a well-developed undercovering of serrated non-medullated fibres that cannot be classed as anything but wool. It would appear as if in the domesticated breeds of sheep the skill of the breeder has more or less eliminated the true hair coat and developed

a fleece consisting only of underwool, but in many cases this under-covering may not consist of fibres that are of a true wool type. It is perhaps possible that in the dense wools, such as Merino, the fleece represents underwool with complete elimination of the hairy overcoat, while in the long wools the fleece may represent the modification of the hairy overcoat into wool.

FOUR TYPES OF FIBRES.

Examination of any long-woolled sheep, such as the Romney or Lincoln, shows that four types of fibres may be present—namely, (1) face and leg hair, (2) kemps, (3) medullated wool-fibres, and (4) non-medullated wool-fibres (true wool).

Face and leg hair: These are of true hair type, containing medulla, cortex, and scales closely pressed on to the cortex, the whole fibre often flattened more or less in outline, and short and pointed. Very considerable variation in the harshness or softness of these hairs can be noted even by the hand. Wherever the fibres are more or less circular in outline and show distinct signs of serration they are soft to the touch, and softness of face and leg hairs is apparently always connected with absence of kemps and absence of medullated wool-fibres.

Kemps: These, of course, are well known to all sheep-breeders, and are likely to be found in all breeds, the long wools being no worse in this respect than the short wools. Kempes are structurally almost indistinguishable from face and leg hair, but are more slender and longer, though generally much shorter than the average wool-fibres; also like the face and leg hairs, they have a limited life, shedding themselves and not continuing to grow from year to year as in the case of wool. The presence of kemps is, of course, quite objectionable from the manufacturer's standpoint, but New Zealand wools are by no means conspicuous in the amount of kemps they contain. In fact,

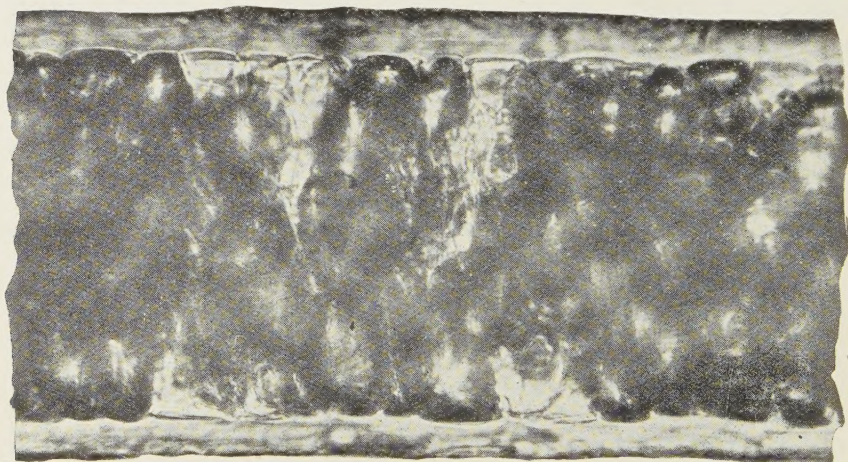


FIG. 3. WOOL-HAIR, SHOWING ALMOST THE WHOLE OF THE FIBRE OCCUPIED BY MEDULLA. $\times 400$.

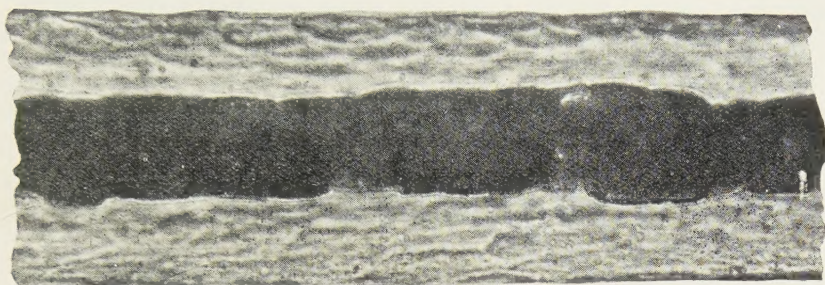


FIG. 4. WOOL-HAIR, SHOWING WELL-DEVELOPED MEDULLA AND SCALES CLOSELY PRESSED ON TO THE CORTEX. $\times 400$.

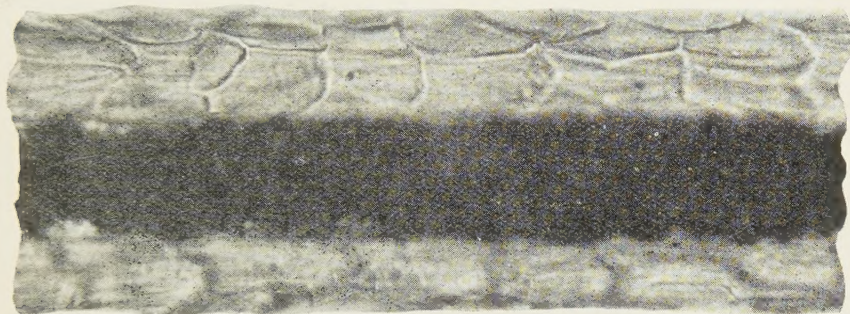


FIG. 5. WOOL-HAIR, SHOWING MEDULLA AND FAIR SCALE-DEVELOPMENT. $\times 400$.



FIG. 6. TRUE WOOL-FIBRE, SHOWING POINTED SCALES. $\times 400$.

[Microphotos by Biological Laboratory.]

in comparative absence of kemps New Zealand wools compare more than favourably with the average British wools. The term "kempy" wool is often applied to coarse, fairly straight britch-wool, but such wool does not consist of kemps, but is generally thick medullated wool-hair.

Medullated wool-fibres: These consist of fibres of equal length to those of the ordinary fibres of the fleece; at times they may be longer than the surrounding wool-fibres. In certain instances they are coarser than the rest of the fibres, but in many cases their count or thickness may be less than that of the ordinary wool-fibres. They contain a

medulla or central strand, which may vary considerably in thickness. The cortical tissue is generally poorly developed, and this results in almost complete absence of any elasticity. The scale-structure is often quite well developed, particularly if the sheep possessing such medullated wool-fibres have been kept well fed and are not exposed to hard conditions. When fairly straight and possessing no curl or crimp they can be readily picked out by hand, but when possessing a decided crimp, which they frequently do, microscopic examination is often necessary to decide whether they are true wool or not.

Non-medullated wool-fibres: These contain no central strand or medulla, the whole of the tissue, with the exception of the scales, consisting of a compact mass of fusiform cells of very considerable elasticity. By possessing no medulla they can be looked upon as true wool, and represent the type of fibre it should be the aim of all wool-growers to produce. During my investigation it became abundantly clear that it is the presence of medullated fibres in excessive amounts that has caused the complaints that have been levelled against some of our Romney and Romney-cross wools, although such are not the only New Zealand wools in which medullated fibres are conspicuous.

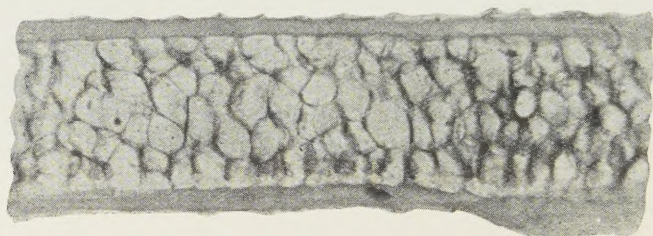


FIG. 7. LONGITUDINAL SECTION OF WOOL-HAIR, SHOWING STRUCTURE OF THE MEDULLA. $\times 400$.

[Microphoto by Biological Laboratory.]

SIGNIFICANCE OF MEDULLATED FIBRES.

Although without doubt the main source of complaint against New Zealand Romney and Romney-cross wools is based on the presence of considerable proportions of medullated fibres throughout the fleeces—or, in other words, the presence of what may be termed wool-hairs—such wools are no worse in this respect than similar wools elsewhere. For instance, the proportion of wool-hairs in a number of British-grown wools examined has been shown to be in many cases very high. It is, however, being generally recognized that such wool is not suitable for the production of really high-grade clothing. As New Zealand wools of all classes have hitherto held a very enviable reputation on the world markets, it will be a sound policy for New Zealand wool-growers to be on their guard against allowing any increase in the amount of hairy wool produced in our clip.

A feature with regard to wool-hairs is the fact that their presence tends to cause dryness of the fleece, leading to the production of dry, wasty, and brittle tips. Whether this is due to the amount of yolk

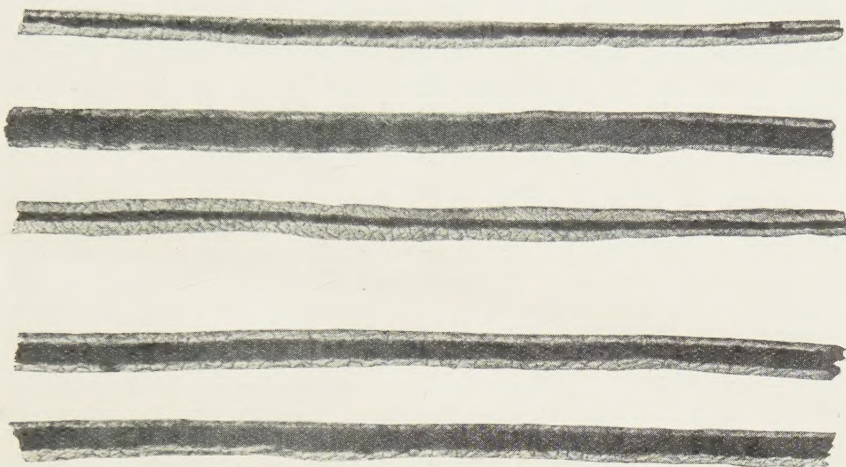


FIG. 8. FIBRES FROM ROMNEY FLEECE CONTAINING WELL-DEVELOPED MEDULLA.
× 120.

Such fibres are really hair, and may be termed wool-hairs.

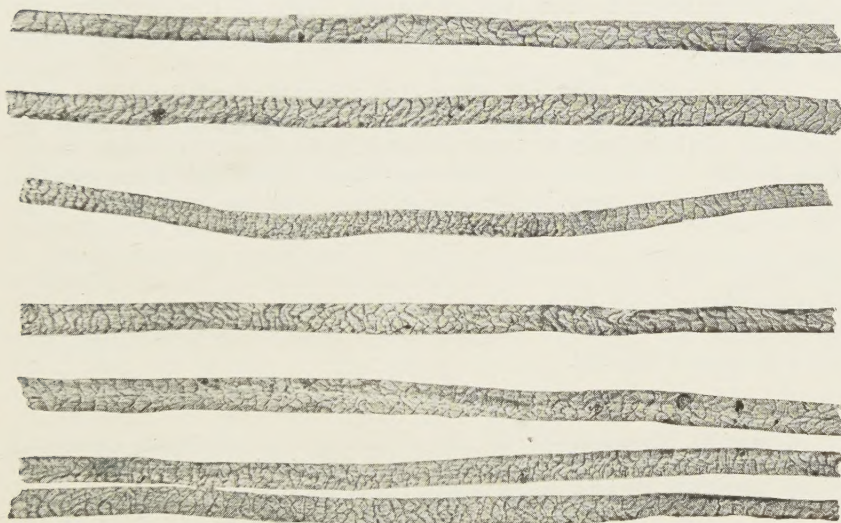


FIG. 9. GOOD TYPICAL ROMNEY WOOL, SHOWING COMPLETE ABSENCE OF ANY
MEDULLA. × 120.

[Microphotos by Biological Laboratory.]

produced being less, or whether a greater amount of yolk is necessary to lubricate medullated fibres properly, is not known. The fact, however, remains that hairy wools tend to dry out excessively, and when this takes place the scaling of the medullated fibres becomes more like those on true hair than on true wool. As has been mentioned, the

presence of wool-hairs is in New Zealand not confined to any one breed, but certainly occurs in higher proportions in Romneys and Lincolns than in any others. In fine wool such as Merino they are rare, except on the lower portions of the britch, but in Corriedales they may at times be found scattered throughout the fleece, indicating perhaps their Leicester or Lincoln origin, both these breeds being extremely prone to the development of medullated fibres.

During an examination of many Romneys, Lincolns, and English and Border Leicesters great variation in the amount and type of medullated fibres was found. In general, even on the best of woolled sheep a small proportion of medullated fibres will be found on the britch, but the rest of the fleece may consist of true wool. In other cases a large proportion of medullated fibres is present on all portions of the fleeces, and many Romneys and Lincolns may contain no true wool, or what I have termed true wool, every fibre of the fleece being of the medullated type. The amount of medulla and its thickness vary very much—from almost the whole of the fibre consisting of medulla to only scattered portions of medulla being present in isolated patches through the centre of the fibre. The main objections to medullated fibres are four in number: they produce a harsh-handling fleece; they produce a dry, light fleece; they produce a non-elastic fibre; and they give a dull appearance to the fleece. This last feature is very characteristic, and is due to the fact that air in a very finely divided state occurs in the cells of the medulla, and this does not allow light to pass through the fibre, but reflects it from its surface.

It is essential that all sheep-breeders, particularly those with Romneys and Lincolns, should make every endeavour to breed out the tendency of their flocks to produce medullated fibres. In other words, they should aim at producing true wool rather than hair masquerading under the title of wool. The use of rams showing any sign of hair-like fibres in the shoulder-wool should be avoided. So far as the britch-wool is concerned, a small proportion of hair-fibres is always likely to be found. It is the presence of medullated fibres in the shoulder-wool that should be specially guarded against, as rams possessing this defect undoubtedly are prone to transmit medullated fibres rather than true wool to their offspring.

Contagious Mammitis.—While this disease gave a considerable amount of trouble and was no doubt the cause of great financial loss (states the Director of the Live-stock Division in his annual report for 1923-24), it did not appear to be quite as prevalent as during the two previous seasons, this being particularly marked in the Canterbury-West Coast and the Otago-Southland Districts, and an improvement was also noticeable in the Wellington District. Observations have again shown the disease to be more troublesome where milking-machines are in use, and want of ordinary care in regard to cleanliness and sterilization of machine-cups, &c., and want of constant care in the daily hand examination of the udders, are a very important factor in the spread of this disease throughout a herd. During the year 794 samples of milk were received at the Veterinary Laboratory, Wallaceville, from cases of suspected mammitis. Of these, 343, or 43 per cent., were found on examination to be from cases of contagious mammitis, 226 were of the non-contagious type, and the remaining 225 were normal.

VARIATIONS IN THE PERCENTAGE OF BUTTER-FAT IN MILK.

II. DAILY VARIATIONS.

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THE majority of dairy-farmers know that cows vary in test from milking to milking and from day to day, and that these variations, although small on the average, may at times be practically nil, while at others they may be very considerable; but it is doubtful if the causes of these changes and their significance are so well known. Tests quite often vary extremely, and seemingly for no apparent reason, but experience teaches that there is practically always a reason if the full facts are carefully studied, and that, after all, the ways of the cow are not strange. As one writer aptly puts it, "She does and she doesn't, and then she does neither, only because we are not keen observers of the reasons for the changes." Of course, the reasons for small or normal variations are not so readily apparent as in the case of extreme variations, but from a careful study of the latter much may be learned in regard to the former.

The causes of the fluctuations in the quality of milk from milking to milking and from day to day may be grouped under two headings—natural and unnatural. The former include causes due to the state of health and to the period of menstruation of a cow, while the latter include causes due to the length of the interval between milkings, weather, exercise, treatment, food, and general conditions. As practically all causes are controllable, it is possible for the dairy-farmer to remove those which give detrimental effects. This can be done only by systematic and regular attention to details of care, feeding, and treatment.

As the result of numerous investigations, the factors influencing the daily test have been fairly definitely established. Still it has to be admitted that knowledge is scant in regard to the physiological reasons for the fluctuations, and that little progress can be expected until more is known about the functioning of the glands of the cow's udder, and the manner in which they manufacture the various components of milk and from what sources. As authorities differ on various points, this article is more an attempt to set out briefly what is known on the subject, and review it as comprehensively as knowledge will permit, than to supply definite reasons on all points of its many and varied phases.

MORNING'S AND EVENING'S MILK.

Evening's milk, as a rule, tests higher than morning's milk, even if the intervals between the milkings are equal. Although it has not been definitely settled why this is the case, most authorities put it down to the fact that during the daytime there is a greater metabolic activity than during the night-time, and that more fat is then in circulation in the blood. It is also attributed by some as being a provision of nature in order that the calf may be better able

to withstand the colder temperatures during the night. It would be interesting to obtain data in order to ascertain if this difference in quality of milk is less at later periods than just after calving. In all probability this should be the case if the foregoing statement is true, for the need of richer food for the calf at night would naturally be less as it grew stronger. In general, a rising temperature lowers the test and a falling temperature raises it, but only by small amounts, and this may have some bearing on the change in quality of milk for milkings at different times of the day. However, the main reason for the difference in the quality of morning's and evening's milk is due to the length of the interval between milkings, since, as a rule, cows are milked later in the morning than in the evening, and the test is generally higher for the shorter interval. By making the milkings earlier in the morning than in the evening it is possible to have the morning's milk test higher than the evening's milk.

LENGTH OF INTERVAL BETWEEN MILKINGS.

It has been shown that a cow tests higher for the shorter interval than for the longer interval, and as cows, as a rule, are milked later in the morning than in the evening, this partly accounts for the morning's milk being poorer in butterfat than the evening's milk. The truth of this seems to have been definitely established, seeing that the greater the difference in the length of the intervals between milkings the greater is the difference in tests for those milkings. Thus it might be expected that with equal intervals and milk-yields the tests should be equal. Speaking generally, however, this has not been found to be the case, although the difference has been small in most instances. The probable effect of the temperature at the time of the day of the milkings must not be overlooked, however. It seems from this that until the effect of the one is definitely settled that of the other will remain indefinite. Some say that a cow used to being milked at unequal intervals fails to give equal tests for equal intervals because of having long accustomed herself to the other conditions.

FIRST AND LAST MILK.

As the milking proceeds, the richness of the milk increases uniformly portion by portion, commencing with a low and ending with a high butterfat-testing product. The reason for the "fore-milk" testing lower than the "strippings" seems to have given considerable trouble, since so many different theories have been advanced by way of explanation of this difference.

The chief theories put forward are as follow :—

(1.) The butterfat-globules in milk vary in size, the foremilk containing the greater percentage of small globules, and the strippings containing the greater percentage of large globules. The explanation is that the larger globules are held back mechanically in the very fine passage-ways of the udder, the network of extremely fine tissues acting as an obstacle to their ready release.

(2.) The pressure due to the quantity of milk in the udder retards the secretion of butterfat, and as the pressure is released during milking the rate of secretion of butterfat is correspondingly increased.

(3.) Butterfat, being the lightest constituent of milk, rises to the surface on standing, and this is believed to take place to some extent in the udder of the cow, with the result that the last milk is the richest. This is given only as part explanation.

(4.) The butterfat is secreted and held captive in certain cells in the glands of the cow's udder, and as these become more and more distended with butterfat they rupture. The number of cells rupturing per unit of time increases during milking, and therefore the last milk is the richest.

It will be readily apparent that opinions differ considerably, and a brief discussion of their respective merits may be of advantage—taking the foregoing theories seriatim.

(1.) As the size of the fat-globules is so minute, it is thought unlikely that they could be held back mechanically to any extent—especially as the pressure of secretion normally moves down through the upper tissues of the udder to the cisterns situated just above the teats. Owing to the viscous nature of butterfat, the globules may have power to adhere to the tissues and so retard their downward progress, but this will hardly account for the fact that it is chiefly large globules which have been found in the upper tissues of the udder on post mortem examination immediately after milking. A point worth noting in this connection is that the average size of the fat-globules increases uniformly during milking.

(2.) This theory is rather difficult to establish by means of experiment, but if it held good it would mean that immediately secretion had recommenced after complete milking had been effected the rate of secretion of butterfat should be greater than at any other time, as the pressure in the udder would then be at its minimum. The rate of secretion of milk is believed to somewhat depend on the pressure of milk in the udder, and it is reasonable that this should apply to each component of milk as well.

(3.) The third theory is based on the fact that the range of variation in quality between the first and last milk is greater where a cow has stood quietly for some time before milking than where a cow was taken direct from pasture and milked. Also, if a cow is allowed to stand for an hour or so, and the udder thoroughly massaged before milking, the range of variation in quality from first to last milk is found to be less than in either of the other two cases. This seems fairly definite, and is put forward as being only one of the probable causes.

(4.) This theory was based on the fact of finding by microscopic examination many ruptured butterfat-secreting cells in the glands of the udder when it was cut open immediately after complete milking than after partial milking. The theory has much to commend it, and at the same time should be considered in conjunction with the second theory, since the rupturing of the highly distended fat-cells would no doubt be greatly facilitated by the reduction of internal pressure in the udder.

NUMBER OF MILKINGS PER DAY.

The difference in quality of milk from milking to milking is usually more marked with three milkings than with two, and with four than with three. This is probably accounted for partly by the difference

in the length of intervals, and partly by the effect of change of temperature during the day. It is claimed that the average daily test is raised slightly for an increase in the number of milkings. Milk and butterfat production may be somewhat increased by this means, and it is considered possible that the test may also be raised slightly, if only because of the second and fourth theories as presented under the heading of "First and last milk." It is estimated, however, that the increase would not be very permanent, and would merely be noticeable for a short time immediately following the change.

MILK FROM DIFFERENT QUARTERS.

Two or three investigators have stated that milk varies in quality and quantity for the different quarters of a cow's udder, and that the milk from the left fore quarter usually tests lowest, while that of the right back quarter tests highest. Others in commenting on this statement point out that the order of milking the quarters may have considerable bearing on the question, and in view of the facts it is highly probable that this is the sole reason for the variations discovered, and that the quality does not appreciably differ.

SKILL AND SPEED OF MILKING.

Skill and speed of milking also have influences on the test, inasmuch as it has been proved that the longer a person takes to milk the lower the test may vary from normal. Not only this, but a skilful and fast milker, as is well known, will obtain more milk; and it is probably because of this fact that he also obtains a richer milk, owing to the larger quantity of last milk obtained. With a slow milker the cow does not respond so readily, and does not give down all the milk possible, and thus, owing to the small amount of true strippings obtained, the milk is poorer than normal.

PARTIAL OR INCOMPLETE MILKING.

This is practically the same thing as dealt with in the preceding paragraph, only that in that case incomplete milking is done unwillingly, while in this it may be done with intent. When milk is left in the udder as the result of incomplete milking, will this affect the test for subsequent milkings, and in what way? As a rule, the test for the incomplete milking is lowered, and those for the next milking or two are raised, but not by very appreciable amounts, and without absolute surety. The case of what is known as a cow "holding" her milk may also be considered. According to most writers on the subject, this does not take place, as it is contended that a cow is unable to wilfully hold her milk. All milkers will have noticed that there comes a pause in the flow of milk during milking, and that this usually occurs before the middle of the milking, and that by working at the teats the flow comes again. This secondary milk is said to be "made while one waits," or, in other words, the cow secretes this extra amount by a "reflex" action, doubtless because of nature's provision to satisfy the calf should the supply of milk in the udder become fully exhausted. If a cow is upset or excited, or slowly milked, she does not secrete so much of the secondary milk, for the reason that the nervous system unconsciously controlling the process does not come

into action so readily as is the case when conditions are favourable. Thus it is not a case of the cow refusing to give down or prevent the escape of any milk already in the udder. Some say this "secondary" milk, as it may be called, amounts to nearly two-thirds of the total quantity given at a milking, while others consider it less than this amount, and others, again, discredit it entirely. The art of milking is in obtaining as much of this secondary milk as possible; the "reflex" action soon ceases if the necessary stimulus is not maintained which excites the nerves that bring it into play. If this milk is not obtained, or only partly obtained, the test, as a rule, is lowered as in the previously mentioned cases.

METHOD OF MILKING.

It is contended by a few investigators that the test can be raised in milking a cow by taking diagonal pairs of teats instead of the conventional method of taking front and back pairs. Then, again, it might be suggested that side pairs could be taken, especially as each side pair is connected with a separate mammary gland. Besides this, it is said that by having two milkers, and milking all quarters simultaneously, both quality and quantity of milk are increased. This statement is not well authenticated, as little evidence has been brought to light in regard to the matter, although it is considered quite likely that the yield of milk would be slightly increased, especially since milking two quarters at a time gives better results than one quarter at a time.

FEED.

Many farmers have endeavoured, without or with little success, to raise the test by the use of certain kinds of feed. It can be safely stated that there is no feed which will of itself appreciably raise the test. By the use of certain feeds it is possible to raise the test by small amounts, but such increases are usually only temporary, and soon decrease again. Provided a cow is well fed and receives a good variety of palatable food which supplies the essentials, she will return as much butterfat by this means as by any other, and with less trouble to the feeder. If a cow is starved the milk decreases, and the test usually rises slightly, but only for a short time, for she then draws on the fat of her body to help keep up the quality of her milk, and as these stores become depleted the milk gradually becomes poorer in quality and falls below normal.

WATER-SUPPLY.

Shortage of drinking-water decreases the milk-flow and usually increases the test slightly. Very cold water is also a cause of decrease in the quantity of milk, but its effect on the test is practically nil. The effect of unclean water would be to upset a cow, with a consequent reduction in her milk-yield, and in all probability a fall in test as well.

EXERCISE AND TREATMENT.

Exercise, provided it is not excessive, has a stimulating effect on cattle—much as it has on human beings—and the appetite benefits accordingly. In this country cows are not housed for any period of the year, and therefore receive plenty of exercise and fresh air, and this is probably the reason for the fact that the average tests

for the various breeds in New Zealand are higher than those for the same breeds in most other countries. If the exercise is fairly strenuous it results in a reduction of the yield of milk, and is accompanied in most instances with a rise in the test, but should the exercise be very severe both may be detrimentally affected.

Ill treatment has a similar effect, and, if persisted in, may cause permanent lowering if not absolute cessation of production for the lactation period. However, due no doubt to the adaptability of the cow, the test always tends to return to normal after being affected by such means.

HEALTH AND CONDITION.

The state of health or condition of a cow has considerable influence on the amount and richness of her milk. Generally when a cow is slightly ill or slightly injured the milk-yield is reduced, with an accompanying rise in the test; but should illness or injury be of a severe nature the cow may go completely dry, and in any case will drop very low in yield. The test in such cases is erratic, and may be up or down, or both alternately, but is lowered as a rule. The condition of a cow influences the test, but as the animal loses or gains condition gradually the effect on the daily tests is negligible.

PERIOD OF MENSTRUATION.

As a rule, the milk-yield is slightly lowered when a cow is in "season," although some cows show little difference. When the yield is lowered the test generally shows a rise, but provided the yield is not appreciably influenced the test remains practically normal. In some cases, however, the test may vary up or down considerably, and no definite explanation can be given. It is usually in such cases that the milk-yield shows considerable variation also, being perhaps down one milking and up the next.

WEATHER.

As a rule, very rough and bleak weather reduces the milk-flow and test as well, but where cows are well protected the effects are very slight. Fine, cold weather, when the air is clear and fresh, tends to raise the test, while hot or warm muggy weather tends to lower it. The reason for this is that in the former case the appetite is stimulated, with a resulting larger amount of food consumed, while in the latter case the effect is just the opposite. In fact, there seems good reason to believe that a cow feels the effects of the weather much as do human beings. A point worth mentioning in regard to influence of weather on the test is that the effect is often belated, and does not fully manifest itself until, perhaps, the second milking after the change, or even later.

GENERAL CONDITIONS.

Under this heading are included such changes that may tend to upset a cow, such as change of field, disturbance by dogs, presence of strangers, excitement, change of milkers, and so on. The effect of these conditions depends on how much the cow is upset; as a rule, they have a more noticeable effect on the milk-yield than on the

test, unless, of course, the period of distress is longer or severer than usual for such causes. Cows will often fret considerably when separated from others or from their usual surroundings, and this results in a reduction of milk-production and usually an increase in the test. The case of a cow being separated from her calf after calving is of little importance, since no reliable test can be obtained from her milk until about the fourth day, and by that time she will be more settled.

CONCLUSIONS.

From a careful study of the variations of daily tests and of their causes it appears that there are three main rules which govern these fluctuations, but it must be remembered that they are not invariable, and that they merely represent the general tendencies. They are briefly as follows:—

(1.) The test varies inversely with the milk-yield, provided that the variations in the milk-yield are not of an extreme nature, in which case no definite rule can be given.

(2.) Whenever the test is influenced by any means it soon tends back to normal, and usually in doing so swings slightly past normal in the other direction before returning to normal.

(3.) In the case of a cow receiving good feeding and attention generally the test cannot be permanently raised by any appreciable amount by the use of special feeds.

(To be continued.)

NOTES ON THE OCCURRENCE OF CERTAIN EXOTIC PLANTS IN NEW ZEALAND.

H. H. ALLAN, Feilding.

INTEREST in the exotic plants occurring in New Zealand has been quickened by the publication in recent years of two important books—"The Naturalization of Animals and Plants in New Zealand," by G. M. Thomson, and "Tutira: The Story of a New Zealand Sheep-station," by H. Guthrie-Smith. The former contains a careful account of all the exotic species recorded up to the date of its publication, with valuable historical notes; the latter is a truly unique work, which belongs to that rare class of books that are at once science and literature. No student of natural science on its ecological side can afford to neglect "Tutira."

But there still remains much misunderstanding of the true status of naturalized plants in New Zealand, notwithstanding that Dr. L. Cockayne, in several of his writings, has clearly stated the true position. One may quote from his great work, "The Vegetation of New Zealand," the following: "*Wherever any part of New Zealand is in its primitive condition and uninterfered with by man or the animals he has introduced, none of the exotics have gained a foothold, their great powers of dissemination notwithstanding, although the virgin*

area may be pierced in all directions by ground occupied by man where there are introduced species in plenty. On the other hand, where man has separately or collectively brought into play fire, draining, cultivation, and introduced domestic or feral animals, he has created a new environment where indigenous and introduced species, if the latter be present, alike go to the wall and new associations arise, or are purposely produced, made up, it may be, purely of exotics, though frequently of such and native plants. Thus there are two distinct areas, the one dominated by primitive New Zealand conditions and the other by such as approximate to those of Europe, while between these extremes is a gradual series of intermediates."

Now, although long lists of so-called "naturalized" plants may be and have been misleading, it remains true that it is important to record the occurrence of new exotic species as such becomes known. Especially is this true from the farmers' point of view. Plants that are a menace to pastures or arable land, or are poisonous to stock (only recently a case came under my notice of a farmer who had fed off a luxuriant growth of hemlock with dire results!) or harmful in other ways, may become established because no special notice was taken of their first appearance, nor inquiries made of their possible significance. The authorities are keen to prevent the entry of alien weeds, but their efforts should be supplemented by those of all interested in the welfare of the land. Many a serious weed has crept in unnoticed, established itself in an obscure corner, advanced stealthily through the land, and suddenly the farmer finds that a new enemy is in arms against him. The Noxious Weeds Act may be read over the delinquent, but the time for most effectively dealing with the pest has passed. Here our schools could help valuably, both by training pupils in the art of keeping their eyes open, and by acting as centres to which farmers could send specimens of suspicious plants for forwarding to those who could supply the necessary information about them.

A striking case that came under my notice is that of the establishment of *Hieracium praealtum*, which in Canada and the United States goes by the name of "king-devil," and thoroughly earns its title. Hidden away in the recesses of stream-gorges at Mount Peel and the Orari Gorge, Canterbury, it flourishes in profusion, and thence has spread along the Rangitata and Orari Rivers on to the upper pasture-lands and roadsides of the plains. It has also been found to the north of the Ashburton River. The plant bears long, blue-green, rather hairy leaves in rosettes, and sends up well-branching heads of dandelion-like flowers which set quantities of seed easily spread by the wind. In addition it sends out from the base long arching runners which bend down and root in the soil, and, growing vigorously, produce strong new rosettes. Finally, a patch of considerable size may be produced. So well established is this species that the chances are remote of its being eradicated, and unless close watch is kept it may become a pest of serious moment. Canadian experience shows that the plant is refused by stock, spreads easily, and, once established, is very aggressive and difficult to get rid of.

Hieracium Pilosella (mouse-eared hawkweed) was observed to be well established in certain pastures near the Hinds River, Canterbury

Plains, but in its present state could be eradicated if seriously tackled. This species is a low-growing plant, its short runners producing a dense mat, to the exclusion of other vegetation. The flowers are like pale yellow dandelions, on single stalks, and the leaves blue-green and very hairy. As it flowers abundantly its spread is only a matter of time. This is a case where timely action will prevent a great deal of subsequent bother. In Canada it is considered even a worse pest than the king-devil, taking absolute possession of entire fields.

Hieracium aurantiacum (orange hawkweed) has been recorded as occurring at the Waiau, North Canterbury. Several small patches were noted in a pasture near Ashburton, but at my suggestion were cultivated out, and did not return. It is of similar growth to the king-devil, and has quite pretty orange-coloured flowers in abundance. "If possible, the sentiment of an entire neighbourhood should be aroused against orange hawkweed, for, with a plant of this quality, the careful farmer is largely at the mercy of any slovenly cultivator who chooses to be regardless of communal welfare," says Ada Georgia ("A Manual of Weeds"). It is said that small patches in pastures may be killed out by covering them with salt at the rate of 18 lb. to the square rod.

Cerastium arvense (field mouse-ear chickweed) is well established in certain pastures at Ashburton. While not so virulent as the previously mentioned plants; it is an undesirable pasture-weed, despite its rather pretty appearance when covered with small, graceful, white, starry blossoms. It is not difficult to get under control in arable land.

Crepis biennis (rough hawksbeard) is a common plant in Ashburton grassland. It is similar in appearance and characteristics to the widespread and abundant smooth hawksbeard (*Crepis capillaris*), but is large and covered with rough hairs. The two species hybridize, and therefore intermediates are not uncommon. It may here be mentioned that the common New Zealand pipiri (*Acaena Sanguisorbae* vars.) hybridizes with the Australian sheep's burr (*Acaena ovina*) where the two occur together.

Lamium amplexicaule (henbit deadnettle), recorded by Armstrong for Canterbury in 1879, is a common weed in rich garden soil at Ashburton.

Other species that may be mentioned are: *Ranunculus Lingua* (great spearwort), which is naturalized in certain water-races near Longbeach; *Papaver hybridum* (field-poppy), occurring in arable land, Ashburton; *Trifolium striatum* (striated clover), closely related to the more common scarab clover (*Trifolium scabrum*), infrequent as a roadside plant, Ashburton; *Caucalis daucoides* (burr parsley), a weed of waste places at Ashburton; *Salvia Verbenaca* (wild sage), recorded for Auckland, occurs sparingly in dry pastures at Kakariki, near Feilding; *Valerianella Locusta* (lamb's lettuce), recorded as *V. olitoria* for several places in the North Island (a specimen of this from near Akaroa was given to me by Professor Wall, of Canterbury College); *Veronica scutellata* (a water-speedwell) occurs in certain ponds near Feilding, and another species, related to *Veronica anagallis-aquatica*, occurs in ponds along the Waitaki River, near Glenavy; and *Juncus*

acutus (a tussock-forming rush), which is well established in sand-hollows at Foxton. For the identification of this last species I am indebted to Mr. D. Petrie.

Harbours are a favourite place for aliens to secure a foothold, and should be closely watched so that dangerous species can be eradicated when first observed. The classical example of these "ballast-plants" for New Zealand is that described by Kirk in the *Transactions of the New Zealand Institute* for 1895 (vol. 28). In the year 1912 I observed the following species at Oamaru Harbour: *Scleropoa rigida*, a quaint grass that has been recorded from a number of places, but does not increase; *Asphodelus fistulosus* (onion-weed), a bulbous liliaceous plant, said to be fairly common in the northern parts of the North Island, that is considered a serious pasture-weed in Victoria, and is well established at Oamaru Harbour; *Emex australis* (spiny dock), which died out in a few seasons; *Argemone mexicana* (Mexican poppy), (this made the harbour gay for several seasons, but at my suggestion steps were taken to eradicate it, I understand successfully); *Diplotaxis tenuifolia* (one of the rockets), related to *D. muralis*, also naturalized, which was plentiful and thoroughly at home at the harbour.

The vagaries of certain species afford an interesting study. Some, having gained a foothold, seem unable to spread farther; others spread rapidly, and then seem to fade away; others, again, spread steadily. *Eruca sativa* (a cruciferous weed), reported as occurring on the Great Barrier Island by Kirk, remained rare till the recent increase in lucerne-growing, when it became familiar. It has not yet, however, earned the title of a naturalized plant elsewhere than in the place of its first discovery. *Matricaria suaveolens* (= *M. discoidea*, rayless mayweed), since its first record in 1882 in Auckland, has spread steadily southward, and is now a familiar roadside weed almost throughout the North Island. *Lactuca muralis* (wall-lettuce), common in Marlborough in 1906, has spread rapidly of recent years in damaged forest in the upper Motueka and Motupiko valleys. *Ottelia ovalifolia* (a pond "lily"), first observed in Auckland in 1897, is now common in ponds as far south as Feilding at least. *Alisma plantago-aquatica* (water-plantain), recorded in Hawke's Bay in 1892, and near Marton in 1906, has now crossed the Rangitikei River from the latter place. *Polygonum Hydropiper*, apparently only recorded for the East Cape district, is a most abundant plant on river-beds and water-races at Ashburton, and is also abundant in similar situations near Feilding. On the other hand, *Scandix Pecten-Veneris* (shepherd's needle)—to take one example of a weed decreasing in virulence—once very abundant near Ashburton, is now exceedingly rare in that neighbourhood. The whole subject of the ups-and-downs of exotic plants is of considerable interest, and not unimportant, but is beyond the scope of the present article, the main object of which is to suggest the advisability of prompt record of the appearance of new plants in a district.

My identifications of all the species here mentioned, except *Juncus acutus*, were concurred with by the late Mr. Cheeseman, who took a deep interest in the question of the naturalization of exotics, and was ever ready to assist the student with his wide knowledge of these plants.

LOSS IN WEIGHT OF STORED APPLES.

OUTLINE OF FLESH-COLLAPSE EXPERIMENTS IN NELSON DISTRICT, SEASON 1924.*

R. WATERS, Plant Pathologist, Biological Laboratory, Wellington.

EXPERIMENTATION with cold-storage conditions for determining their possible relation to the physiological disease of the apple known as flesh-collapse is scarcely practical even in the smallest commercial chambers. Two to five thousand cases is a large amount of fruit to have at stake, and there is considerable risk in subjecting such a quantity to a set of conditions widely divergent from those in current practice. Under the circumstances, however, this was required to be done. The immediate losses in cool store and elsewhere had to be checked while the cause and remedy of the disease were being sought. These requirements demanded, firstly, some alteration and improvement in the general storage programmes in vogue; secondly, increased vigilance, so that excessive losses might be avoided by timely unloading if necessary; and, thirdly, the institution of experiments with cool-storage conditions on a large scale in commercial chambers—for there is no other accommodation. The responsibility of such a procedure was duly represented to all concerned. The growers, however, responded by volunteering thousands of cases of apples for treatment under certain new storage conditions that had promise of success, and the local cool-store companies willingly co-operated by offering the requisite space and facilities for extensive experimentation.

NATURE OF THE 1924 EXPERIMENTS.

Under these circumstances about seven thousand cases of apples mainly Sturmers—were finally placed under experimental conditions. These were distributed among four separate cool-storage companies. Two of these companies received only a few cases each; the other two took the bulk, for one of them had allotted a five-thousand-case and the other a two-thousand-case chamber especially for experimental purposes. The results obtained from these two experimental chambers are being used from time to time as a guide to the general storage programme for the non-experimental chambers, which are of various sizes and have a total capacity of over sixty thousand cases.

Of the seven thousand cases thus placed under experimental conditions the bulk was picked—cases being marked with the date of picking—by twenty different growers in the ordinary commercial way, but more or less at a time that was freely advertised as the best for cool-storage purposes by the Department's Horticulturist, Mr. W. C. Hyde, and the writer. This resulted in the delivery of a considerable proportion of the Sturmers, and even of other varieties, at an earlier stage of maturity than that chosen in 1923. It is believed that this in itself accounts to some extent for the much better results obtained

* An account of previous work in this investigation was published in the *Journal* for July, 1923, page 32.

this season. "Packing-out" returns are being supplied by these twenty growers as the fruit is sent to market.

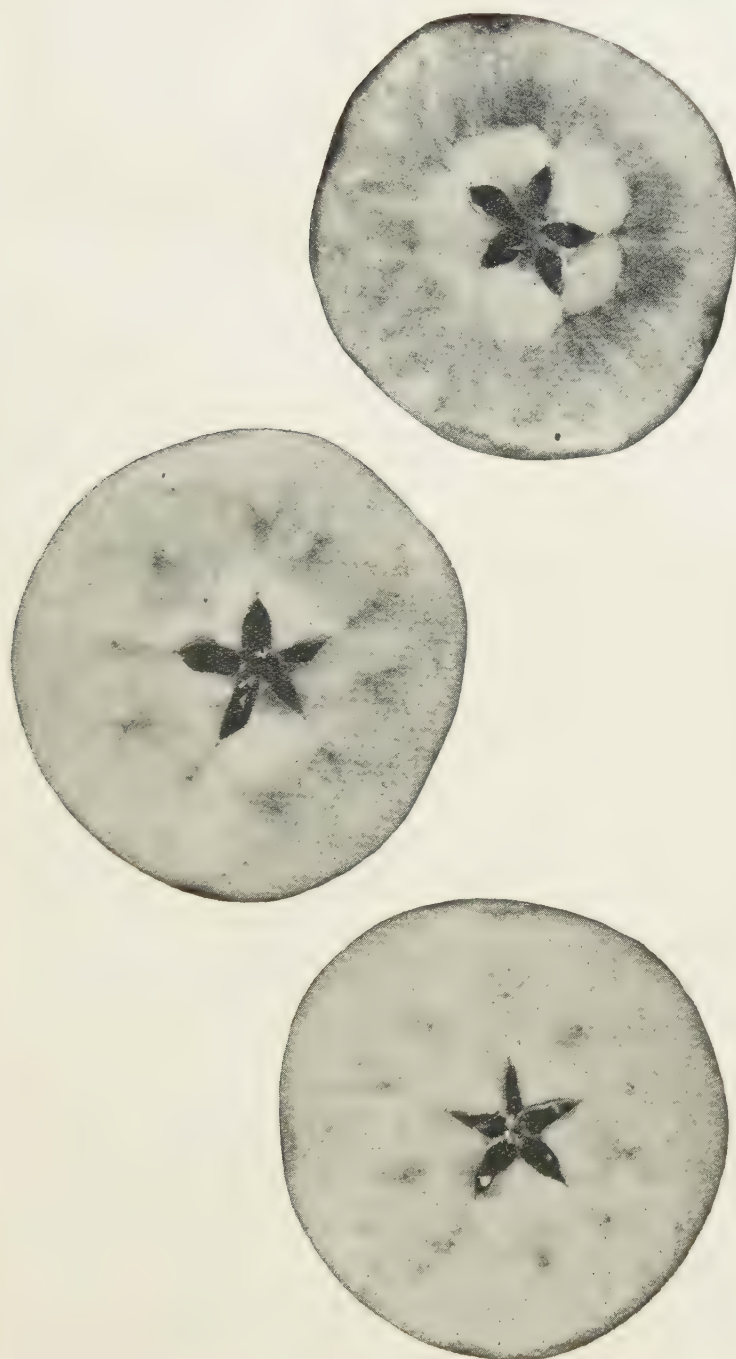
The remainder of the seven thousand cases—230 cases in all—were picked by the Horticulturist and the writer from two orchards the fruit of which in previous years had suffered in cool store up to 40 per cent. and more from flesh-collapse. One of these orchards is on rich alluvial land, and the other on relatively poor hill country. The fruit from one went into the five-thousand-case experimental chamber, while that from the other went into the two-thousand-case chamber.

The owners of the two orchards each set aside a plot of Sturmer trees for these experiments. From each of these plots six "first picks" were made, a fresh set of trees being used for each pick and the most advanced fruits being selected each time. (See explanation (d) at end of article.) Each of these six first picks provided five cases of a bushel each for an experimental chamber, and five for a non-experimental—that is, an ordinary commercially run chamber-control. The first, third, and fifth of these first picks also provided five cases for storage in the packing-room of a cool store at natural temperatures and humidities; and also for one case, the fruit of which weighed exactly 30 lb., for an experimental chamber; one similarly for a non-experimental chamber-control; and one likewise for a packing-room at natural temperatures and humidities. These were for the loss-in-weight experiments. (See explanation (c).)

The first of the first picks was made well before any other growers had picked Sturmers for storage. The fruit was by no means full-sized, and was, of course, immature—2nd March for the two-thousand-case chamber, and 5th March for the five-thousand-case experimental chamber. The last of the first picks was made after all growers had stripped their trees. The fruit was dropping from the trees, and was, of course, overmature—29th May for the five-thousand, and 2nd June for the two-thousand-case experimental chamber. The four intermediate picks were made at intervals.

In addition to this, two "second picks" (see explanation (e)) were made from the trees off which first picks had already been taken, in each case five cases being provided for an experimental chamber and five for the non-experimental chamber.

Thus it will be seen that arrangements were made to demonstrate in two experimental chambers belonging to two separate cool stores the best stage of maturity at which to make the first and second picks of Sturmers for the peculiar storage conditions it was decided to provide. The five cases taken at each pick provided for five examinations of the internal and external conditions of the apples from time to time, this being part of the vigilance programme. The fruit in the packing-room was to enable a comparison to be made of the relative advantages in delaying the advancement of maturity and in arresting the development of rots, shrivel (see explanation (b)), flesh-collapse, &c., under the experimental conditions as against those of unrefrigerated storage. The fruit in the non-experimental chamber would, it was hoped, show the relative advantages in similar respects of the customary methods of each cool store as against the new method in the experimental chambers. It will be seen later that these hopes have not been fully realized. Finally, the nine lots of accurately weighed fruit at each



MEDIAN TRANSVERSE SECTIONS OF EPPS' SEEDLING APPLES FROM COOL STORE.

Showing (1) a healthy apple; (2) an apple slightly flesh-collapsed, notably from its ten primary vascular bundles outward; (3) an apple badly flesh-collapsed in the cortex, but not in the pith or centre.

[Photo by H. Drake, Biological Laboratory.]

store would, by subsequent periodical weighings, enable the progressive loss in weight in the packing-rooms, the experimental chambers, and the non-experimental chambers to be determined. From results thus secured in the experimental chambers it would be possible to estimate what was the average loss in weight for the whole of the fruit in these chambers (seven thousand cases), and to accelerate or retard this loss in weight as one thought fit. Again, seeing that the loss in weight would certainly be greater in the packing-sheds than in the experimental chambers, and greater in the experimental chambers than in the non-experimental chambers, it would be possible to note any detrimental effects arising from progressive losses in weight among the few cases in the packing-room long before such losses had been effected amongst the seven thousand cases in the experimental chambers. Similarly, any detrimental effects would manifest themselves among the seven thousand in the experimental chambers before they were allowed to show themselves amongst the sixty thousand cases in all the remaining non-experimental chambers.

Experimentation under the circumstances has not been altogether satisfactory from a scientific standpoint. It has been difficult and sometimes impossible to secure exactly the desired conditions, nor has it been possible to attain that precision which is so essential for proof in experimental work. It is believed, however, that when the experiments are completed they will at least direct attention to a fundamental principle in cool storage which appears to have been hitherto overlooked—a principle that may prove to be of value in cool storage both on land and sea, and one that will amply repay further investigation on more exact lines. The experiments had another three months to run, dating from the last examination at the end of August last, but there was no commercial damage to Sturmers in the experimental chambers at that time, whereas last year up to 50 per cent. of deterioration from flesh-collapse had occurred before that date. There is another important point: The apples from the experimental and some of the non-experimental chambers are in a most desirable condition for transport—that is, slightly wilted (see explanation (a)), and are arriving on the market with remarkable freedom from bruising and case-marks. This is due directly to the conditions under which they have been stored.

It remains now to set out briefly the lines on which these experimental chambers are being run, and this at once involves a consideration of the subject of loss in weight.

LOSS IN WEIGHT:

The writer has long been aware of the different treatment apples receive in different cool stores or ships, in different chambers in the same store or ship, and even within the walls of the same chamber. The limited value of a thermometer or two, or even of thermometers and hygrographs, has become more and more obvious. They cannot be dispensed with, but they show little of the actual effects of the storage conditions on the fruit.

The dairying industry has a more perishable product to handle than apples. The industry certainly uses instruments, but the principal "instrument" is the product itself. If the milk was

not quickly cooled or was badly handled in transit the evidence is sought in the milk itself. Milk is rejected, or received and paid for, on its condition. Throughout the whole process of cheese and butter making the milk—or its product—is the main indicator of the effects of past conditions imposed upon it, and of what to do next. This makes for uniformity in the final results with milk from different breeds of cattle, on different farms, and in different factories and stores.

The possibilities of similarly using the living apples as the indicators of the progressive effects of cool storage and as a guide to cool-store management have long appealed to the writer. With this in mind, a start was made in judging the prevailing store-temperatures by a thermometer sunk in the flesh of the apple. Valuable as this guide is, especially early in the storage season when air-temperatures are fluctuating, it soon became plain that the effects of one cool-store condition could not wisely be judged or experimented with apart from the others. Did there exist, therefore, any single physiological result in the apple that was conveniently measurable, and that was affected to some extent by all the factors employed in the production of cool storage for apples?

At this stage the writer made a review of the cool-store factors, from which it appeared that the "loss in weight" of the fruit, while apparently not much affected by ordinary *ventilation*, indicated to some extent the cumulative effects on the fruit of the other cool-storage factors—namely, *circulation*, *temperature*, *humidity*, and *loading*. Thus, firstly, in a cold-air blast system the longer the hours of circulation per day, or the faster (within limits) the circulation, the greater will be the volume of air passing over the fruit, the greater the amount of water carried from the apples, and consequently the greater the loss in weight. Compare eight hours' circulation with sixteen hours' circulation, or the slow circulation of a direct-expansion or a brine-circulation system without a fan with the faster circulation of a cold-air blast system. Secondly, the higher the flesh-temperature the faster the evaporation and respiration, and consequently the greater the loss in weight. Compare the rapid wilting and no flesh-collapse in unrefrigerated sheds with the slower wilting in cool store; or the more rapid wilting and less flesh-collapse in cool stores run at relatively high flesh-temperatures with the absence of wilting and abundant flesh-collapse in cool stores run at low flesh-temperatures. Thirdly, the higher the atmospheric temperature the greater the carrying-capacity per unit volume of air, consequently the greater the loss in weight. Fourthly, the lower the relative humidity the faster the absorption of water, gases, &c., from the apples, consequently the greater the loss in weight. In a chamber where a high carbon-dioxide concentration had accumulated there would, no doubt, often be a high relative humidity and a consequent small loss in weight, notably in chambers without fans on board ship. Fifthly, the smaller the total number of bushels in a chamber the smaller the total volume of water, gases, &c., to be removed; the quicker, therefore (within limits), their removal per bushel, and consequently the greater the loss in weight. The converse may be particularly important where storage is close and holds are tight on board ship, especially where temperatures are high, or where there is no special circulation or water-extracting system as under the brine-circulation system.

From a number of reasons of this kind adduced from the experiments and observations of the last three years it appeared that the circulation, temperature (flesh and atmospheric), humidity, or loading could not be altered without affecting the loss in weight; conversely, the loss in weight could be increased or diminished by increasing or diminishing the circulation, temperature, and humidity or loading, and that an increase in the loss in weight would probably arrest the development of flesh-collapse. What proportion of the total loss in weight might be due to temperature and what to humidity in a given temperature-humidity ratio per hour of circulation and with definite loading was unknown for any chamber. Likewise it was unknown what were the proportions of water, gases, &c., that made up the total loss in weight at different temperature-humidity-circulation ratios.

Seeing, however, that the loss in weight promised to be of some use as an indicator of the composite effects of these four cool-storage factors on the apples, and that an increased loss in weight might reduce the amount of flesh-collapse, it was later decided to attempt to regulate the experimental chambers, using the loss in weight as the indicator as to whether the circulation, temperature, or humidity should from time to time be increased or diminished.

The next question that arose was, What total amount of loss in weight should one aim to secure in the storage season? If the loss in weight could be reckoned as a measure of the physiological activities in the apple it was considered a probable indicator of the rate at which the apple was approaching the end of its commercial or of its natural life; under present circumstances there seemed no urgent need to prolong the commercial life much longer than November—that is, seven to eight months' cool storage. Again, if the larger loss in weight in unrefrigerated stores meant a quicker exhalation of noxious substances from the internal atmosphere of the apple, and consequently no flesh-collapse, then, seeing that one of the objects was to determine whether an increase in the customary losses in weight in cool store would decrease the percentage of flesh-collapse, it was decided to produce by November the maximum loss in weight that could safely be effected without commercial injury to the fruit from shrivelling, rots, or advanced maturity. This maximum loss in weight was first roughly determined by the triplicate loss-in-weight experiments carried out in each of the packing-rooms at natural temperatures and relative humidities. Under these conditions the loss in weight was very rapid, and it was quickly shown that 40 lb. of Sturmers could lose over 1 lb. in weight without any change in their commercial appearance; that 40 lb. of Sturmers could lose 2 lb. of weight without resulting in any commercial damage; that when 40 lb. under these conditions had lost 3 lb. in weight slight shrivelling resulted; and that when 40 lb. had lost 4 lb. the apples were damaged commercially. These results indicated that for the purposes of this experiment the maximum loss in weight by November should be about 40 oz., or $2\frac{1}{2}$ lb., per 40 lb. of Sturmers.

Having decided to effect this total loss in weight between the receipt of the fruit—say, in April—and its despatch from the cool store—say, in November—the next point to speculate upon was the best rate at which to effect that loss in weight month by month. Seeing that

flesh-collapse had formerly appeared early in June—that is, in the first ten weeks of storage—and that the cool-storage conditions previous to that time were believed to have induced this disease, it was decided that a very large proportion of the total loss in weight should be effected in the first six weeks of cool storage, so as to prevent flesh-collapse if it was to be done by this means. Accordingly 24 oz.—which was roughly half the loss in weight in the first six weeks shown to have taken place in the packing-rooms where no flesh-collapse develops—was adopted as the amount of loss in weight for the first six weeks in the experimental chambers. Thereafter the monthly loss was gradually to taper off to the minimum in November.

Seeing now that 24 oz. per 40 lb. of Sturmers had to be extracted in the first six weeks, the next requirement was to decide what hours of circulation, temperature, and humidity would be required to bring this about. The rate of loading was not controlled, and the results now indicate the improvement that could have been made by regulating this factor. As nothing short of an actual trial would determine this point, it was decided in the first two or three weeks of storage to effect as large a loss in weight as it was possible. Thus the experimental chambers had to be run at as high a temperature and as low a humidity as could safely be maintained—adequate ventilation being provided. The following are the reasons on which the theoretical initial flesh-temperature-humidity ratio was decided on :—

Firstly, Winkler, working on the physiological disease known as “internal browning” in the Yellow Newton apple, arrived at the conclusion that in commercial practice it would probably not be expedient to store apples above 5° C. (= 41° F.). Guided by this statement, it was decided to fix the initial flesh-temperature range at 38–40° F. at either of the two points in the chamber midway between the centre of the chamber and the ends, and midway between the ceiling and floor. At either of these two points in a chamber that reversed its air-current regularly would the mean temperature of the store be met with. Secondly, in New Zealand, where the mean recorded temperature from January to December is 53° F., and the mean recorded relative humidity 75 per cent. of saturation, flesh-collapse does not occur among apples stored in ordinary farm-sheds or in unrefrigerated sheds built for the short storage of apples. These meteorological records probably do not represent the true averages of temperature and humidity, but they were the only figures available at the time, and an attempt was made to find how the same loss in weight could be effected at a mean flesh-temperature of 39° F. in the experimental chambers. The problem, therefore, of obtaining in the first two or three weeks the same loss in the experimental chambers as took place in unrefrigerated sheds may roughly be stated as follows: With a temperature of 53° F. and a relative humidity of 75 per cent. of saturation a certain loss in weight takes place outside: how much lower would the relative humidity require to be to effect a similar loss in weight when the temperature is reduced to 39° F.? In other words, when the temperature is 39° F. what relative humidity in the atmosphere will admit of the absorption of the same weight of water per cubic foot of air as is absorbed when the temperature is 53° F. and the relative humidity 75 per cent. of saturation? The answer is, A relative humidity of 59 per cent. of

saturation. Obviously, for several reasons, this figure is only approximate. The loss in weight is not due only to water. Then, again, the problem does not take into account the decreased rate of evaporation at 39° F. as against 53° F., nor does it include the differences in the circulation under natural conditions in ordinary storage-sheds as compared with that in cool stores with a definite circulation outfit. However, it was decided to see what loss of weight would be effected by a flesh-temperature range of 38° to 40° and a relative humidity under the discharge or inlet duct not lower than 60 per cent. of saturation at the end of each day's run.

Summarizing the actual results, it may be said that only occasionally was the relative humidity brought down into the sixties, and the difficulties of getting it down increased as the experimental stores became more fully loaded. The definite weights of Sturmers (30 lb. lots) placed in the experimental and non-experimental chambers were weighed from time to time to ascertain the progressive loss in weight and to enable an idea to be formed of what was the loss in weight of the bulk of the fruit in each chamber. The loss in weight for the bulk was estimated as from a "mean loading-date." This date was set down after considering what was the date midway between the first and last receipts into each chamber, and on what date each chamber was half-filled. A programme was then drawn up showing the weekly losses in weight necessary to secure a total loss of 24 oz. per 40 lb. of Sturmers in the first six weeks, and a total of 40 oz. by the end of the storage season. It was not found possible to secure as great a loss as was desired at the flesh-temperature range of 38-40° in the first six weeks, but later on, when the required loss per week became less as per programme, and better appliances and methods were devised, this deficiency was gradually overtaken. Thereafter, from time to time, the hours of circulation were varied in total length of time, or made intermittent each day (two shifts); the air-current was variously limited at the duct doorways; the flesh-temperature was reduced and the humidity raised by allowing the temperature of the brine dripping over the battery-pipes to become warmer and of lower specific gravity—all this to limit the loss in weight, the problem soon becoming how to keep the rate of loss down.

The loss in weight has fallen from 0.7 oz. per 40 lb. of Sturmers per day during the first week's storage to 0.2 oz. per day at the end of August. As the rate of loss was gradually brought down, so the six first picks at intervals between 2nd March and 2nd June were successively being brought into cool store. Thus the daily rate of loss in weight has been smaller for each successive pick. This will provide an interesting series of different losses in weight, and will also demonstrate one of the irregularities of treatment under commercial conditions in the same chamber where the "loading in" spreads over a long period of time for any chamber; for the greater the load the smaller the loss per bushel. The tendency has been to bring about a greater drying-power and a greater loss in weight, both in the experimental chambers and also in several commercial stores, more or less generally. So far these conditions have been attended with very good results indeed. The experimental stores would have profited by more ventilation. There is a great fear of introducing moisture

in ventilating, and demonstrations were made and tables of equivalent relative humidities worked out to avoid this. When the introduction of water means the snowing-up of battery-pipes and difficulty thereafter in defrosting, this fear may have some justification, for the defrosting of the coils and the extraction of water from the chambers are more difficult when working about 32°. But with higher temperatures and greater drying-power, such as have been in practice this season in certain stores, there is little difficulty in these respects, and the writer is not able to see why any harm should come from a little moisture being brought into a chamber under such circumstances, provided it is extracted, say, in the next twenty-four hours.

Records are being kept of the discharge and flesh temperatures and the relative humidity, and estimations of the daily losses in weight are being made from periodical weighings of the definite weights of apples. While the results to the end of August were most encouraging, it is not claimed that the optimum loss-in-weight programme has been attained. It is confidently believed, however, that if this programme continues to give such good results, then the loss-in-weight figures will enable the programme to be repeated with considerable accuracy in other stores or under other circumstances. An examination, however, of the data collected may show where improvements could be made during the coming season.

At the commencement of the storage season it was considered that much of the ordinary commercial space would be run on lines similar to, or differing only a little from, those of past years, and consequently that marked differences in the temperature-humidity ratio, and therefore in the losses in weight, would prevail here as compared with the experimental chambers. The controls were on this account set up in the non-experimental space. The tendency of the store-proprietors, however, has been from time to time to bring the conditions of the non-experimental chambers more closely than was anticipated to those of the experimental chambers. It remains to be seen how much this will affect the controls and interfere with the evidence of the experiments from a scientific standpoint.

EXPLANATION OF TERMS.

In the course of this article use has been made of several terms that require a little explanation.

(a.) "Wilt": A freshly gathered apple is hard to the touch. When pressed firmly enough with the thumb it yields, and when it yields the tissue ruptures. There is little or no resiliency. When, however, an apple is wilted through loss in weight its hardness gradually decreases. In the case of Sturmers it was found that the decrease in hardness was only barely perceptible to the touch when the loss in weight had reached 20 oz. per 40 lb. of fruit (= 3 per cent.). Resiliency at this stage was perceptible when the stored apple was compared with one freshly gathered from the tree. The tissues when pressed with the thumb yielded, but were not quite so liable to rupture. Such fruit would carry better than fresh fruit. The term "wilt" is meant to include this condition from the time it is first perceptible to the touch onward to a certain point just before the skin first shows signs

of wrinkling. Therefore the wilted apple is not wrinkled or shrivelled, and is therefore not damaged commercially in this way.

(b.) "Shrivel": When the loss in weight in Sturmers reaches about 32 oz. per 40 lb. of fruit (= 5 per cent.) the first signs of shrivelling in a case are liable to appear, more especially on apples adjacent to the thick wooden ends. The amount of shrivelling, however, is only very slight, and late in the season one would commonly find apples decidedly more shrivelled selling readily at good prices. Very little increase in the amount of shrivel was noticeable, even when as much as 40 oz. per 40 lb. of fruit (= 6 per cent.) had been lost. A general condition of shrivel in a case is regarded as a commercial detriment to the fruit, and this is liable to occur when a greater loss in weight than that just stated is effected. Nevertheless the writer has a number of records in his notebook of only slight commercial damage occurring after a loss in weight of 48 oz. per 40 lb. of fruit (= 7.5 per cent.).

(c.) "Loss in weight": This expression is specific enough in itself, inasmuch as it covers no more than the actual weight by which the fruit is reduced. The expression has no reference to the nature or the proportion of the various constituents which leave the fruit and thus reduce its weight, and herein lies a most promising field of inquiry. While two entirely different ventilation-temperature-humidity ratios could effect precisely the same loss in weight, there are reasons for suspecting that such identical losses in weight would not be composed of the same proportions of water, carbon dioxide, esters, &c. If this be true, then the temperature-humidity ratio may possibly be adjusted not only to increase or decrease the total loss in weight, but also to increase or decrease the evolution of any of the constituents which are lost. One of the problems that presses for an answer may now be enunciated as follows: If identical weights of a certain apple-variety are exposed to different temperature-humidity ratios which effect the same total loss in weight, what are the proportions of the various substances which leave the fruit for each ratio?

(d.) "First pick": It will be noted that six "first picks" were made. The object of this was to demonstrate the best stage at which to *start* picking Sturmers. An attempt was therefore made to secure six positively different stages of maturity, and to ensure this a large number of trees on even ground were set aside for the experiment. Every time a pick was made a fresh set of trees was used, and from each set of trees the most advanced or the ripest fruits were selected. This meant that not only was each successive pick made because the fruit looked more mature, but also because the fruit had actually been on the tree longer and therefore was more mature—the fruit of each pick coming from corresponding positions on different but adjacent sets of trees, thus securing uniformity. A large proportion of the fruit of each tree was taken at each pick, leaving a smaller proportion which included the fruit low down among the forks of the main branches, where ripening is slow and even the texture of the flesh appears distinctive. Each of these six picks was therefore a "first pick" for the set of trees off which the fruit was taken, and thus there were six "first picks."

(e.) "Second pick": The "second picks" were made from trees off which "first picks" had been taken. The fruit had a distinctive appearance, as much of it came from low down on the tree and on the inside where it was less exposed to the sun.

APPRECIATION.

The experiments this year are somewhat extensive, and their success to date has been accomplished by virtue of the hearty co-operation of a number of fruitgrowers and others who are deeply interested in cool storage. My thanks are due to the growers—some twenty in number who volunteered large quantities of their fruit for experimental purposes, and more particularly to Messrs. R. B. Jackson, of Nelson, and W. E. Rowling, of Riwaka, who contributed a large number of cases of fruit to be cut up from time to time for examination. I must also thank the directors of the Nelson Freezing Company and the Motueka Cool Storage Company for the storage facilities they have afforded me, and Messrs. N. B. Brown, T. Morgan, A. Ercolano, the refrigerating engineers at Stoke, Motueka, and Port Nelson respectively, for their co-operation and willing assistance at all times. Finally, I desire to acknowledge the advice and assistance I have received from my fellow-officers, Messrs. G. Stratford and J. H. Thorp, the local Orchard Instructors, and also Mr. W. C. Hyde, Horticulturist, who has been closely associated with me throughout the investigation.

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ALBANY EXPERIMENTAL AREA.

OPERATIONS IN 1923-24.

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THE earlier stages of the 1923-24 season in the Auckland District proved distinctly unfavourable to the working of gum-land soils. The winter and early spring were too wet to permit of seasonable cultivation, while the dry weather following baked the soil hard. Somewhat droughty conditions continued up till March, when a humid autumn set in. These conditions served to demonstrate the drought-resisting qualities of kikuyu grass, paspalum, Japanese millet, and, to a less extent, of mangolds and cabbages.

ROOT CROPS.

Mangolds had to be sown twice, but then grew fairly well right through the season. Black-rot (*Phoma betae*) made its appearance, somewhat reducing the crop and rendering the harvested roots hard to keep. Top-dressing with 1 cwt. of nitrate of soda per acre (on

12th December) gave disappointing results, the yields per acre being as follow :—

Variety.			Not top-dressed. Tons.	Top-dressed. Tons.
Jersey Queen	..	..	.. 17.8	18.4
Yellow Globe	..	..	.. 14.6	13.3
Long Red	..	..	.. 18.5	18.7

The Long Reds, as usual, proved the best keepers.

A small test referring to the application of manure was also carried out, the fertilizers used being 3 cwt. superphosphate and 1 cwt. blood-and-bone per acre. The result can be expressed as follows :—

Manure sown in same drill as seed	..	..	.. 100
Manure sown broadcast before drilling	..	..	.. 135
Manure sown in drill 2 in. to one side of seed-drill	..	..	.. 94

While this experiment cannot be regarded as being in any way conclusive, it does at least suggest a line of research that might very profitably be followed up, not only with mangolds but with other crops.

Carrots also had to be resown, but made a fair crop.

Soft Turnips were quite successful. Webb's Purple-top yielded the heaviest crop, but Webb's Invincible (yellow-fleshed) gave the best quality, and kept sound considerably longer. Devonshire Grey-stone and Imperial Green Globe were also quite satisfactory, and kept well.

OTHER CROPS.

Cabbages.—This crop once again proved its suitability for clay soils in a dry summer. Though badly attacked by diamond-backed moth, the yield was excellent (about 20 tons per acre), considering that the variety was Early Drumhead, selected for early maturity rather than yield. It is surprising that small dairy-farmers on the gum-lands do not make use of this excellent fodder crop. Cabbages can be raised in a seed-bed and planted expeditiously with the plough. It should be possible to arrange a succession from March to August.

Potatoes.—Experiments with selected seed were continued, but with indifferent results. The first crop was vigorous in the haulm, but yielded very poorly; the second suffered badly from an attack of *Phytophthora infestans* blight during the heavy autumn rains. It is fairly safe to assume that the land is unsuitable for the cultivation of potatoes, more especially when it has been cropped for a number of years.

Japanese Millet and Red Clover.—This was quite a successful crop, though, owing to the dry summer, the clover was not particularly prominent until the late autumn, after the millet had been cut for hay. This should be a useful means of utilizing land after a crop of millet has been taken, the clover providing feed and green manure preparatory to grass-sowing the following autumn. The best results were obtained by drilling a mixture of 12 lb. Japanese millet and 6 lb. red clover. This experiment will be repeated on a grazing basis.

Kikuyu Grass (*Pennisetum clandestinum*).—This grass did well, coming away in early October and growing steadily till late in July. The kikuyu and Lotus-major plot was particularly strong, with the kikuyu and white clover a good second. The pure kikuyu plots were again unproductive owing to sod-binding and nitrogen-exhaustion, but responded well to nitrate of soda.

On a plot planted in spring with kikuyu and paspalum the former was well ahead throughout the season, though the paspalum will probably thicken out next year.

MINOR PLOTS.

On the smaller plots kudzu vine again failed to come up to expectations, and honey-locust did not germinate. Japanese millet and spring tares proved a useful forage mixture, and several varieties of maize were grown. Owing to their miniature size and proximity to the shelter-belt these plots were harried by small birds (sparrows, larks, and Californian quail).

COTTON.

Durango cotton was again tried, but failed to grow satisfactorily till the really warm weather arrived. It was badly attacked both by root-fungus and *Phytophthora infestans*, and though many bolls were formed none reached maturity. It would appear that this crop is not as yet an economic possibility in the Auckland Province, though possibly cotton could be obtained by raising the young plants in a cold frame and planting out in November.

SULPHUR AND PHOSPHATE EXPERIMENT.

In order to obtain some light on the availability of insoluble (tribasic) phosphates in rock phosphate when used in conjunction with sulphur, either free or combined, trials were carried out, using blue lupins and soft turnips as subjects. The lupins were decimated by a root-fungus and had to be ploughed in; the turnips gave a purely negative result. It is possible that in the dry weather prevailing almost throughout the experiment the manures had a depressing effect.

TOP-DRESSING OF PERMANENT PASTURE.

Experiments on the Albany showground were continued, the plots being manured in June and cut for hay on 30th November. There was no outstanding difference between the various plots, but the yield and quality of herbage of the whole of the manured area were in marked contrast to the surrounding unmanured pasture. A portion of each plot was top-dressed with 1 cwt. of nitrate of soda per acre in September. These sub-plots appeared to be more vigorous and of a darker colour.

LAYING DOWN LAND IN GRASS.

Seeing that the area has now been used for many years for manurial and other experimental work, and owing to the expense and uncertainty of cropping small plots over a number of years, occasioned by disease, bird-attack, and the necessity for employing a team by contract, it has been deemed advisable to lay down about half the land in grass of a more or less permanent nature. It had been intended to sow grass last autumn, but late removal of crops, followed by wet weather, delayed the operation, which was carried out in September. This area has been sown in various mixtures, including wild white clover imported from England. It should now be possible to fence off and graze all grass-plots instead of being compelled to cut them.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

TARANAKI, WANGANUI, AND FEILDING DISTRICT COMPETITIONS, 1923-24.

J. W. DEEM, Instructor in Agriculture.

THESE competitions were carried out last season on similar lines generally to those of previous years. The Farmers' Union, individual farmers, and officers of the Education and Agriculture Departments again co-operated in control. The root-growing consisted of mangolds and carrots in North and South Taranaki, and mangolds in the Wanganui and Feilding districts. Calf clubs were again confined to Taranaki. The poultry club which had been started at New Plymouth lapsed during the season, but is expected to be set going again this year. Altogether a total of seventy schools took part in these competitions.

ROOT-GROWING.

The season was somewhat irregular for root-growing. Mangolds did well, except that in some places they suffered a little from heart-rot. Carrots promised to be good, but suffered severely in exposed positions from a salt-laden westerly storm in March, which cut the tops back badly and stopped root-development, considerable numbers rotting. This trouble was responsible for the falling-off in the carrot averages. On the whole, cultivation showed marked improvement, and in some of the schools that had been competing for two or more years it was almost perfect. In this connection special mention should be made of Motunui School, in North Taranaki, and Rawhitiroa, in South Taranaki. Five out of nine plots at Motunui gained full marks for cultivation, while the others were only a few points behind. Rawhitiroa started out with thirteen plots, and presented the same number of first-class plots to be judged. Material for a total of 544 plots was supplied to competitors, and of this number 335, or 61.5 per cent., were presented in a creditable condition for judging. A large number of plots were ruined by stock gaining access to them before judging-time. Unfortunately, the parents are to be blamed in these cases, and regret must again be expressed that there are some who appear to take no interest in the movement and will not assist their children in protecting their plots. It is found that where the parents and teachers are interested the work is a success, but where this support is lacking the results are very moderate.

The heaviest mangold crop was 138 tons 13 cwt. per acre, against 132 tons 5 cwt. in the previous season. This very fine crop was grown by Jean Miller, of Oeo, Taranaki, who also wins the Stuart Wilson Cup and the Agriculture Department's gold medal for the best crop grown in any of the school competitions throughout the Dominion. The average for all the mangold crops was 56 tons 14 cwt., against 48 tons 1 cwt. in the previous season.

The champion carrot crop—58 tons 10 cwt.—was grown by Freda McNeill, of Rawhitiroa. As already mentioned, the season was not

a good one for carrots, and the average crop in these competitions was only 28 tons 7½ cwt., compared with 36 tons 8 cwt. in the preceding year.

The placings for the championships are as follow:—

North Taranaki: Mangolds—Tom Graham, Waitara, 1st, weight 108 tons per acre, total points 188½; Monty Honeyfield, Tataraimaka, 2nd, 102 tons 4 cwt., total points 181; Frank Larsen, Okato, 3rd, 90 tons 10 cwt., total points 180½. Carrots—Merle Bowan, Egmont Village, 1st, 46 tons, total points 126; Fannie Topine, Waiau, 2nd, 28 tons 15 cwt., total points 124¾; Dave Blanchard, Tariki, 3rd, 34 tons 1 cwt., total points 120. The prize for the best-kept plot was divided between Donald McKenzie, Joe McKenzie, and Winnie McKenzie, Motunui. These plots were practically perfect, and the judges were unable to separate them.

2 cwt., total points 221; Bernard Taylor, Ngaere, 3rd, 108 tons

South Taranaki: Mangolds—Jean Miller, Oeo, 1st, 138 tons 13 cwt., total points 234½; Olive Warner, Matapu, 2nd, 127 tons 10 cwt., total points 203½. Carrots—Freda McNeill, Rawhitiroa, 1st, 58 tons 10 cwt., total points 150½; Beatrice Oldfield, Okaiawa, 2nd, 45 tons 10 cwt., total points 143½; Alma Cornish, Toko, 3rd, 42 tons 10 cwt., total points 136½.

Wanganui—Feilding: Ivy McKay, Wangaehu, 1st, 131 tons 2 cwt., total points 216; Rona Field, Taikorea, 2nd, 100 tons 8 cwt., total points 190; Flora White, Glen Oroua, 3rd, 104 tons 6 cwt., total points 190. It is worthy of note that Flora White's two sisters, Elsie and Alison, were first and third respectively last year.

The Manawatu, Feilding, and Wanganui executives of the Farmers' Union gave a challenge shield for the school gaining the most points in the district competitions. This was won by Glen Oroua last year. Three schools tied for it in 1923-24—namely, Rongotea, Colyton, and Apiti.

A fine massed display of roots from a large number of the competing plots was made at the New Plymouth, Hawera, and Palmerston North winter shows. Competitive classes were also provided at these shows for club members. These attracted good entries, and afforded an opportunity of instructing the competitors in root-selection.

CALF-REARING.

Calf-club entries equalled those of the previous season, and the number brought forward for judging was rather better—237 against 200. All the calves were grade heifers, and were divided into two classes, one for Jersey or Ayrshire crosses and the other for Shorthorn or Friesian crosses. The number of calves judged in the different classes were Jersey and Ayrshire, 190; Shorthorn and Friesian, 47. At some centres, in addition to the judging for the calf-rearing competition, the calves were judged on dairy type, and this provided instruction to the competitors in selection on type. Many of the yearling and two-year-old heifers reared in previous competitions were also brought forward for judging on these occasions.

This year (1923-24) the 100 points previously allowed for cost of rearing was reduced to 50. This worked better, but it may be

necessary to still lower the points in order to get satisfactory results. Where liberal points are allowed for cost there is a tendency to use foods not enumerated in the schedule and for which no charge is made. For instance, it was found this year that one calf which showed a very low cost for rearing had been fed liberally on potato-water. The highest cost of rearing a calf in South Taranaki was set down this year at £3 1s. 10d., against £2 2s. 6d. in the previous year; the lowest at 3s. 5½d., against 3s. 6d.; and the average at 16s. 2½d., as compared with 16s. 10d. It should be understood that in these charges no allowance is made for grass or labour. On the basis of 50 points for cost of rearing, one point is deducted for every 1s. of cost; thus if a calf cost 30s. for food 20 points are allowed. Other points are 40 for records and 100 for condition.



JUDGING CALVES AT RAWHITIROA, SOUTH TARANAKI COMPETITIONS.

The championships resulted as follows:—

North Taranaki: Jersey and Ayrshire class—Dorothy Raven, Newall, 1st, total points, 166½; Alan Washer, New Plymouth, 2nd, 160½ points; Madge Flintoff, Durham Road, 3rd, 151½ points. Shorthorn and Friesian class—Dudley Thompson, Hillsborough, 1st, 139½ points; Vera Lambert, Bell Block, 2nd, 133¾ points.

South Taranaki: Jersey and Ayrshire class—P. Wakelin, Toko, 1st, 180 points (food used, new and skim milk, cost 12s. 4½d.); L. Gernhoefer, Rawhitiroa, 2nd, 177 points (new and skim milk, 14s. 6d.); M. Reid, Matapu, equal 2nd, 177 points (new milk, whey, and barley water, 13s. 1½d.); Jane Keighley, Matapu, equal second,

177 points (new milk and whey, 10s. 3½d.) Shorthorn and Friesian class—J. Glen, Ohangai, 1st, 184 points (new milk and whey, 3s. 5½d.); Phyllis Wood, Rawhitiroa, 2nd, 176 points (new and skim milk and Faterine, £1 os. 0½d.); C. O. Connor, Matapu, 3rd, 169 points (new milk and whey, 11s. 0½d.).

Classes are also provided by the various Taranaki agricultural and pastoral associations at their summer shows for club competitors, and this provides a further opportunity for bringing the calves together and preparing notes.

TESTING OF EXPORT BUTTER FOR WATER CONTENT: YEAR 1923-24.

Dairy Division.

THE subject of water content in export butter and the inauguration of an extended official testing system for the Dominion were dealt with in an article published in the *Journal* for October, 1923. Commencing with August of that year—the opening of the 1923-24 season—one box of butter from each churning in the lines received at the grading-stores has been tested for content of water. During the dairy-industry year, August, 1923, to July, 1924, inclusive, a total of 126,095 churnings has been tested. The operation of the system appears to have checked the export of butter containing excessive moisture, inasmuch as no complaints with respect to such were received from overseas markets last season, this being in marked contrast to the number of complaints received in 1922-23.

The results of the testing are shown in the following tables:—

Table 1. *Butter tested for Water Content, August, 1923, to July, 1924.*

Month.	Number of Samples containing up to 16 per Cent. of Water.					
	Creamery.	Whey.	Dairy.	Milled.	Total.	Average Water Content.
						Per Cent.
August	1,521	87	..	..	1,608	14·47
September	4,548	601	..	19	5,168	14·81
October	12,244	1,060	..	18	13,322	15·00
November	17,856	1,206	1	61	19,124	14·89
December	17,894	1,166	..	50	19,110	14·93
January	16,698	1,222	..	51	17,971	14·92
February	13,044	1,118	..	31	14,193	14·99
March	11,479	969	..	25	12,473	15·04
April	8,984	804	..	25	9,813	15·00
May	7,234	711	..	32	7,977	14·87
June	2,494	80	..	22	2,596	14·81
July	1,485	18	..	55	1,558	14·73
Total for twelve months	115,481	9,042	1	389	124,913	14·932

Total butter graded containing up to 16 per cent. of water, 2,472,440 boxes, or 61,811 tons.

Table 2. Summary of Tests up to and over 16 per Cent.

Month.	Percentage of Tests up to 16 per Cent.			Percentage of Total Tests.
	Under 14 per Cent.	14 to 15.5 per Cent.	15.6 to 16 per Cent.	Over 16 per Cent.
August	16.92	73.88	9.20	0.80
September	13.00	72.00	15.00	1.007
October	7.50	73.50	19.00	1.38
November	6.73	78.53	14.74	1.39
December	6.77	79.84	13.39	0.83
January	7.09	78.61	14.30	0.79
February	5.24	80.68	14.08	0.82
March	4.98	80.63	14.39	0.79
April	4.69	82.76	12.53	0.59
May	8.40	77.89	13.70	0.48
June	10.70	76.57	12.71	0.80
July	18.35	67.26	14.37	1.01
Average water content, 14.932 per cent.			Average water content, 16.38 per cent.	

Table 3. Number of Samples containing over 16 per Cent. of Water (Butter returned to Factories).

Month.	Creamery.	Whey.	Dairy.	Milled.	Total.	Average Water Content.
August	13	..	..	..	13	Per Cent. 16.61
September	51	5	..	..	56	16.39
October	182	5	..	..	187	16.37
November	230	16	..	22	268	16.40
December	149	13	..	..	162	16.35
January	134	10	..	..	144	16.43
February	108	9	..	..	117	16.36
March	87	13	..	..	100	16.39
April	56	3	..	..	59	16.36
May	36	3	..	..	39	16.45
June	21	..	..	..	21	16.44
July	16	..	..	..	16	16.45
Total for twelve months	1,083	77	..	22	1,182	16.38

Proposed Staining of Imported Lucerne-seed.—At a meeting of the Board of Agriculture held last month, this question was brought up for consideration by Mr. McLennan, the Auckland Grain, Seed, and Produce Merchants' Association having requested him to place the matter before the Board. Due consideration was given to the fact that the proposed measure, if adopted, would possibly benefit to some extent the Marlborough growers of lucerne-seed, but the Board hoped to see an increase of lucerne sown in the Dominion, and the staining of imported seed would tend to raise the price, which would militate against an increase of the acreage put down. The Board had evidence that the quantity of lucerne-seed imported was small, and that the majority of it was good seed coming from South Africa and Australia. It was suggested that if the Government legislated in the matter the staining should be required to be done in the country of origin. The Board finally resolved to meanwhile take no action, but if necessary at a future date to give the subject further consideration.

A RECONNAISSANCE SURVEY OF PUMICE SOILS.

ROTORUA COUNTY.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

I. MAMAKU.

THE rhyolitic pumice soils of this country differ from other soils in their newness in every respect — agriculturally, geologically, and chemically. Pumice soils are among the latest to be occupied for farming purposes; in a geological sense the pumice is something of comparatively recent origin; while to the agricultural chemist the vesicular and slaggy particles of pumice, having undergone comparatively little of that weathering, oxidation, sorting, and compaction which has been the fate of normal soils, are therefore regarded by him as something of the newest kind.

The Mamaku sandy silts are apparently derived from a similar material to the lowest subsoil, a coarse pumice sandy gravel now of a yellowish colour, which lies from 4 ft. to 5 ft. below the surface directly on the country rock and follows its contours. The pumice-deposit is therefore wind-borne. The nature of the country rock is still open to investigation, but the numerous brecciated necks or pillars point to its being a lava-flow, the alternative theory being that it is a consolidated tuff. The fact that the pumice gravel is not separated from the country rock by any parting of weathered rock, soil, or organic remains of vegetation is highly significant.

The coarseness of pumice soil is the most disconcerting feature to the chemist. According to Hall and Russell ("Soil Surveys and Soil Analyses," *Journal of Agricultural Science*, p. 209, vol. 4, 1911-12), waste and common lands unsuitable for cultivation are characterized by two properties — the presence of (1) large amounts of coarse sand or of coarse sand and fine sand together, and (2) small amounts only of clay and fine silt. The combined results for fine and coarse sand given in these authors' examples of unsuitable soils range from 50 to 88 per cent., the coarse sand from 12 to 68 per cent., the fine sand from 18 to 64 per cent., the silt from 2 to 16 per cent., the fine silt from 2 to 8 per cent., and the clay from 0.2 to 3 per cent.

If we compare these figures with those yielded by the tawa-rimu type of pumice soil given in the accompanying tables it will be seen that if the size only of the particles composing the soil is considered these soils would come very near those stigmatized by Hall and Russell as unsuited for cultivation. The mitigating circumstance in connection with pumice is that, being of a vesicular or highly porous character, and, further, being a mixture of silicates instead of pure silica, it is more easily affected by the weathering agencies of time and by physical and chemical processes incidental to cultural operations than ordinary coarse sandy soil mainly composed of quartz (pure silica); so that with time, working, and the incorporation of organic manures and suitable inorganic artificial fertilizers, pumice soils may be expected to increase greatly in productiveness. The necessity for considering the coarsest type of air-borne pumice

soils as something requiring exceptional treatment must, however, be realized when the figures for the mechanical analyses are studied in comparison with other normal soils and the abnormal soils already referred to even when the favourable humid and equable temperate climate is taken into account.

A mass of pumice buried in the soil will in the course of years naturally disintegrate or, as it is locally termed, "rot," liberating much of the plant-food which is locked up in the vitreous particles; but in order to produce a healthy normal soil the porous nature of the resulting material must be lessened by compacting and by filling up the interstices with decayed plant-remains. The improved quality of sample S 60 as shown by the chemical analysis is doubtless due to the swampy conditions which have prevailed, a rare occurrence in pumice soils, producing a colloidal or plastic soil out of a coarse sand by the aid of plant-remains.

A feature shown by the Mamaku soils is the constant mechanical composition over a very large area. The analysis suggests that within a radius of two miles and a half from the Mamaku Railway-station there is no change except in isolated patches similar to that represented by S 60. This country all bears, or has borne, a virgin forest of tawa and rimu.

Travelling north, as one gets near the Oturoa Road, about five miles from Mamaku, an improvement is noticeable in the texture of the soil, which is much heavier, the coarse pumice being buried under finer material than that which occurs near Mamaku. A little to the north of the Oturoa-Rotorua Road the beech ("birch" of the settler) forest of the Mangorewa-Kaharoa Block is encountered, and here the soil is so perceptibly finer as to necessitate a new name, being now a "sandy loam" instead of a "sandy silt." The former weighs 10 per cent. more than an equal volume of the latter.

In making this reconnaissance care has been taken to eliminate local variations by drawing each sample from distant points in the same type of country. Thus on the birch country the soil has been drawn from three different sawmillers' areas along a five-mile line. The close correspondence of the results in each set of figures for the mechanical analysis indicates that each type is constant over a large area.

A most interesting fact elicited is the correlation of the composition of the soil with the type of vegetation growing upon it. Thus this typical birch forest is not in this area found off the sandy loam, while the tawa-rimu forest occupies the sandy silt. There are indications, however, that the latter forest is invading the area of the former, which is a forest evidently overmature.

The native vegetation found growing on pumice soils may be either lichens, mosses, mat-plants, fern, tussock, scrub, or forest. Forest is the class of vegetation covering that portion of the Patetere Plateau near Mamaku. The forest is of two distinct types. The type most important—because of its extent—is the tawa (*Beilschmiedia tawa*)-rimu (*Dacrydium cupressinum*) forest, the other type being the southern-beech forest ("birch"), the chief trees of which are *Nothofagus fusca* (red "birch") and *N. Menziesii* (Southland or brown "birch"). The tawa-rimu forest occurs over a very large area of country, extending far beyond the limits of the area

described in this paper. The type at Mamaku is extremely uniform in its botanical composition. One may walk for miles through this forest without encountering any variation in the species of trees, shrubs, and herbs which go to make up the indigenous plant covering of this district. Any variety met with is only to be found in the introduced element. A very serious occurrence is the rapid invasion of the blackberry, which spreads apace in all unoccupied areas such as disused tramways. The country is traversed in every direction by the tramways of the various timber concerns which are, or were, working in the district, and the monotony of the forest is a matter which cannot fail to strike the observer who follows these ways. Tawa is pre-eminently the dominant forest-tree. Of the amount of millable timber present in the virgin forest, 75 per cent. is tawa and only 25 per cent. rimu (red-pine). This information, imparted by the most experienced sawmiller in the district, may be taken as indicating the proportion of tawa to rimu in the forest. The leaves of the tawa growing on Mamaku soil have a yellowish-green appearance, which is different from the healthy green colour of the leaves when the tree is found growing on Wellington soils.

Other trees of this forest are tawhero (*Weinmannia racemosa*), rata (*Metrosideros robusta*), pukatea (*Laurelia novae-zelandiae*), hinau (*Elaeocarpus dentatus*), pokaka (*E. Hookerianus*), rewarewa (*Knightia excelsa*), miro (*Podocarpus ferrugineus*), kahikatea (white-pine—*P. dacrydiodes*), matai (black-pine—*P. spicata*), maire (*Olea lanceolata*), tanekaha (celery-pine—*Phyllocladus trichomanoides*). This latter occurs very sparsely throughout the forest, and is often confused with the toatoa (*P. glauca*), quite a different small tree of the *Nothofagus* forest. Another tree only occasionally to be met with—the writer knows of it only on the Rotorua—Oturoa Road—is the mangeao (*Litsea calicaris*).

The abundant small trees and shrubs and lianes are best enumerated in alphabetical order: *Aristotelia racemosa* (wineberry), *Alseuosmia macrophylla*, *Brachyglottis repanda* (rangiora), *Coprosma grandifolia*, *C. lucida*, *C. robusta*, *Coriaria ruscifolia*, *Drimys colorata* (horopito), *D. axillaris*, *Fuschia excorticata*, *Griselinia littoralis*, *Gaultheria rupestris*, *G. antipoda*, *Ixerba brexioides*, *Geniostoma ligustri-folia*, *Leucopogon fasciculatum*, *Leptospermum scoparium* (rare), *Muehlenbeckia complexa*, *M. australis*, *Myrsine salicina*, *Melicytus ramiflorus* (mahoe), *M. lanceolatus*, *Metrosideros hypericifolium*, *M. florida*, *M. scandens*, *Melicope simplex*, *Panax arboreum*, *P. anomalum*, *P. Edgerleyi*, *Parsonsia heterophylla*, *Pseudopanax crassifolium*, *Pittosporum tenuifolium*, *P. cornifolium*, *Quintinia serrata* (rare), *Rhipogonum scandens* (supplejack), *Rubus australis*, *R. schmidelioides* (lawyers), *Senecio Kirkii*, *Schefflera digitata*, *Veronica salicifolia* var.

The ferns and herbaceous plants which occupy the floor of the forest or clearings in it, and sometimes are raised conspicuously above it, are also here enumerated in alphabetical order: *Acaena sanguisorbae* var. (piripiri), *Arundo conspicua* (toetoe), *Asplenium flaccidum*, *Astelia nervosa*, *A. Solandri*, *Cyathea medullaris*, *C. dealbata*, *Danthonia semiannularis*, *Davallia novae-zelandiae*, *Dianella intermedia*, *Drosera binata*, *D. auriculata*, *Earina suaveolens*, *E. mucronata*, *Epilobium pubens*, *E. erectum*, *Gahnia pauciflora*, *G. Gaudichaudi*, *Gnaphalium luteo-album*, *G. involucreatum*, *Gleichenia dicarpa*, *Hymenophyllum*

(several species), *Hemitelia Smithii*, *Juncus bufonius*, *Lomaria capensis*, *L. discolor*, *L. fluviatilis*, *L. lanceolata*, *Lygodium articulatum* (local), *Lycopodium volubile*, *Lagenophora pumila*, *Microtis porrifolia*, *Microlaena avenacea*, *Nertera dichondraefolia*, *Pteris incisa*, *Poa caespitosa*, *Polypodium Billardieri*, *P. punctatum*, *P. pennigerum*, *Pimelia laevigata*, *Pterostylis Banksii*, *Schoenus* sp., *Todea hymenophylloides*, *T. superba*, *Thelymitra* sp.

The second type of Mamaku forest contains as the dominant trees the two species of *Nothofagus*, *N. fusca* and *N. Menziesii* ("birch"), and a common small tree *Phyllocladus glaucus* (toatoa), three plants which do not occur at all in the tawa-rimu forest. Other points of difference are that the small trees *Quintinia serrata* and *Elaeocarpus Hookerianus* (pokaka) are common in the *Nothofagus* forest, and sphagnum bogs are met with. On the other hand, *Phyllocladus trichomanoides* has not yet been observed in the *Nothofagus* forest. This type occurs in the area known as the Mangorewa-Kaharoa Block, lying to the north of the main Rotorua-Tirau Road, when it

TABLE I. MECHANICAL ANALYSES.

(Results, except S 184-186, are percentages on air-dried soil.)

Laboratory No.	Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth " passing 2 mm. Sieve.							Stones and Gravel.		
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.		Loss on Ignition.	
"Birch" Soils.											
R 1123	Sandy loam	0.8	15.6	23.4	23.8	11.2	3.0	3.6	17.8	5.0	
R 1126	"	0.8	15.6	26.8	23.8	11.1	3.4	3.0	14.7	5.5	
R 1138	"	1.3	15.5	19.9	21.8	13.3	4.2	4.4	16.4	Trace.	
R 1140	"	2.0	17.3	19.8	21.5	12.6	4.0	4.3	16.8	"	
R 1142	"	2.1	19.9	23.8	19.8	8.3	3.1	3.8	17.6	"	
S 184	"	1.3	12.9	16.3	15.0	11.1	2.3	31.3	9.6	6.5	
S 186	Fine sandy silt	1.3	9.6	27.1	23.2	10.4	1.4	10.4	16.0	2.0	
S 188	Silt	0.3	4.2	21.5	40.3	15.0	2.8	4.3	10.8	3.2	
R 946	Sandy loam	1.2	19.7	23.8	19.4	10.7	3.6	3.4	15.8	4.5	
R] 947	Sandy silt (subsoil)	0.4	33.2	27.8	15.5	6.1	1.8	3.1	9.6	Trace.	
Tawa-Rimu Soils.											
R 985	Sandy silt	2.0	23.7	23.9	20.5	7.9	2.4	7.1	13.3	Trace.	
R 988	"	1.5	29.5	22.1	16.7	7.3	2.2	8.1	14.1	"	
S 181	"	1.3	30.5	27.4	18.6	8.5	2.3	1.6	9.8	4.5	
182	"	1.1	30.5	26.0	17.7	8.5	1.2	3.1	11.5	3.5	
173	"	1.4	28.9	24.7	17.7	7.6	2.8	2.4	13.7	2.1	

Locality References.

- R 1123: Forest adjoining birch forest, Kaharoa-Mangorewa Block.
 R 1126: Birch forest adjoining above soil, Waihi Company's tram.
 R 1138: Newly grassed birch country, Oturoa (Muir's).
 R 1140: Old grassed birch country, Oturoa (Muir's).
 R 1142: Same type as previous—not birch country (Williams's).
 S 184: Birch forest, Gamman's cutting.
 S 186: Tirau paddock, upper terrace.
 S 188: Tirau paddock, lower terrace.
 R 946: Birch forest, same locality as R 1126.
 R 947: Subsoil of R 946.
 R 985: Railway cutting, Mamaku, 700 ft. above Lake Rotorua.
 988: Scenic reserve adjoining Mamaku Demonstration Farm.
 S 181: Forest, Demonstration Farm.
 182: Scenic reserve adjoining Demonstration Farm.
 173: Demonstration Farm (cultivated soil).

TABLE 2. CHEMICAL ANALYSES.

(Results, except *, are percentages on soil dried at 100° C.)

Laboratory No.	Locality.	Volatile Matter.		Total Nitrogen.	1-per-cent. Citric-acid Extract, Dyer's Method; Hall's Modification ("Available" Plant-food).					Hydrochloric-acid Extract ("Total" Plant-food).				Hydrogen-ion Determination.	Fe (Iron) extracted by 1-per-cent. Citric Acid.
		* On Air-drying.	* At 100° C.		Ignition.	Lime, CaO.	Magnesia, MgO.	Potash, K ₂ O.	Phosphoric Acid, P ₂ O ₅ .	Lime, CaO.	Magnesia, MgO.	Potash, K ₂ O.	Phosphoric Acid, P ₂ O ₅ .		
<i>"Birch" Soils.</i>															
R 946	Mangorewa-Kaharoa Block, Waihi Company's cutting	39	3-36	16-10	0-2-31	0-0-48	0-0-13	0-0-04	0-0-03	0-1-3	0-1-5	0-0-2	0-0-2	5-5	0-19-4
R 1123	Forest adjoining birch forest (1126)	44	3-82	19-58	0-419	0-0-59	0-0-13	0-0-21	0-0-06	0-2-1	0-1-6	0-0-7	0-0-3	4-8	0-09-7
R 1128	Birch forest, Waihi cutting	38	3-22	14-67	0-298	0-0-44	0-0-17	0-0-14	0-0-05	0-2-0	0-1-7	0-0-4	0-0-2	4-8	0-1-39
R 1138	Muir's, Oturoa Road, formerly birch forest	43	4-56	17-43	0-349	0-1-38	0-0-20	0-0-29	0-0-03	0-2-7	0-1-8	0-1-0	0-0-4	5-7	0-09-9
R 1140	Muir's (grassed fourteen years)...	35	3-80	17-83	0-358	0-2-00	0-0-28	0-0-14	0-0-03	0-4-6	0-1-8	0-0-2	0-0-3	5-7	..
R 1142	Williams's, Oturoa Road (twenty-six years)	12	4-26	17-65	0-405	0-1-13	0-0-22	0-0-16	0-0-03	0-3-7	0-1-9	0-0-8	0-0-5	5-9	0-03-9
R 1156	Mangorewa-Kaharoa Block birch forest, Waihi Company's cutting	49	4-22	23-10	0-339	0-1-10	0-0-21	0-0-15	0-0-02	0-2-4	0-1-6	0-0-5	0-0-2	4-8	0-19-3
S 184	Birch forest, Gamman's cutting	..	..	..	..	..	..	..	..	..	..	..	..	4-4	..
S 185	Subsoil of S 184	..	..	..	..	..	..	..	..	..	..	..	..	5-9	..
<i>Tawa-Rimu Soils.</i>															
R 985	Railway cutting, Mamaku, 700 ft.	31	7-08	14-30	0-200	0-0-34	0-0-23	0-0-10	0-0-05	0-1-3	0-1-1	0-0-5	0-0-3	..	0-35-1
R 988	Government scenic reserve, Mamaku	31	8-11	15-31	0-289	0-0-40	0-0-23	0-0-11	0-0-05	0-1-7	0-1-2	0-0-5	0-0-2	..	0-06-2
S 60	Demonstration Farm, Mamaku	..	43-58	16-83	..	0-2-69	0-0-33	0-0-16	0-0-05	0-1-9	0-2-1	0-0-8	0-0-5	..	0-16-6
59	Soil on rhyolitic neck..	..	..	..	0-402	0-1-08	0-0-20	0-0-12	0-0-07	0-2-6	0-1-4	0-0-1	0-0-3	..	0-05-0
211	Rhyolitic country rock, Mamaku	..	43-86	1-07	0-052	0-0-34	0-0-18	0-0-20	0-0-01	0-0-8	0-0-8	0-3-0	0-0-2	..	0-06-7
R 181	Demonstration Farm, Mamaku	..	..	..	..	..	..	..	..	..	..	..	..	5-6	0-07-2
R 183	Demonstration Farm, Mamaku; windmill paddock	..	..	..	..	..	..	..	..	..	..	..	..	5-5	..
R 182	Government scenic reserve, Mamaku forest	..	..	..	..	..	..	..	..	..	..	..	..	4-6	0-05-7
R 192	Mamaku forest	..	..	..	..	..	..	..	..	..	..	..	..	5-6	..

Results of pH determinations of soil and subsoils:—

R 1123/4/5: pH = 4.8, 5.7, 6.2 (rimu-tawa). Oturoa type.

R 1126/7/8: pH = 4.8, 5.4, 6.2 (birch). Oturoa type.

R 1156/7: pH = 4.8, 5.5 (birch).

crosses the Patetere Plateau. Trees of the red-birch measuring 48 ft. in girth have been met with in this area. Other trees, small trees, shrubs, and herbs common in this forest are *Metrosideros robusta* (rata), *Podocarpus ferrugineus* (miro), *P. spicata* (matai), *Dacrydium cupressinum* (rimu), *Weinmannia racemosa* (tawhero), *Ixerba*, *Beilschmiedia tawa*, *Quintinia serrata*, *Myrsine salicina*, *Panax Edgerleyi*, *P. arboreum*, *Elaeocarpus dentatus*, and *Griselinia littoralis*.

Shrubs: *Alseuosmia grandifolia*, *Coprosma lucida*, *C. robusta*, *Leucopogon fasciculatum*, *Melicytus lanceolatus*, *Olearia Cunninghamii*, *Panax anomalum*, *Senecio Kirkii*.

Ferns and herbs: *Astelia nervosa*, *Asplenium bulbiferum*, *A. falcatum*, *Cyathea medullaris*, *Dianella intermedia*, *Gleichenia dicarpa*, *Gahnia pauciflora*, *G. xanthocarpa*, *Hemitelia*, *Hymenophyllum*, *Lomaria discolor*, *Lindsaya trichomanoides*, *Microlaena avenacea*, *Pteris esculenta*, *P. scaberula*, *P. incisa*, *Polypodium Billardieri*, *Trichomanes reniforme*.

CONCLUSIONS.

The chemical analyses of these soils show that both the sandy silts and sandy loams are deficient in available and total phosphoric acid. The amount of iron in the sandy silts extracted by Dyer's 1-per-cent. citric-acid method also shows a deficiency compared with what one finds in ordinary soils. The amount of iron in the sandy loams (birch forest) is from two to four times the quantity found in the sandy silts (rimu-tawa forest).

Although outside the area of which this article treats, two analyses are included showing the composition of the Tirau paddock soil for comparison, as it is in this paddock, which is situated on two river-terraces, that bush-sick stock always recover. It is interesting to note, after making a correction for its higher water content, that the greater part of this paddock consists of soil which bears a very close resemblance, in the mechanical composition, to the birch-forest soils. This and the high amount of "available iron" in the soil naturally suggest that when these lands are cleared and grassed they may be found to be free from bush sickness or iron starvation. Settlers occupying lands along the Oturoa Road are said not to be troubled with this disorder in stock.

The correlation of the quality of the soil with the vegetation growing upon it is a most interesting fact, and requires investigation in the case of other pumice lands.

The chemical analyses were performed under the writer's supervision by Mr. L. D. Foster, Analyst, and the mechanical analyses by Mr. R. E. Grimmett, M.Sc., Analyst.

Noxious Weeds Orders.—The plant woolly nightshade (*Solanum auriculatum*) has been added to the Third Schedule of the Noxious Weeds Act. The Cheviot County Council has declared broom and gorse to be noxious weeds within that County. The Waitomo County Council has declared Californian thistle *not* to be a noxious weed within its district.

THE HUTZELMAN TREATMENT OF FOUL-BROOD IN BEES.

J. A. CAMPBELL, Director of the Horticulture Division.

VERY considerable interest among beekeepers in New Zealand as well as in the United States has been created by what is known as the Hutzelman treatment of foul-brood infected combs. In the latter country the treatment, which consists of the immersion of the infected combs in a solution of alcohol and formalin, has, according to the journal *Gleanings in Bee Culture* and other publications, been largely practised both experimentally and commercially. By this means, if successful, large numbers of combs which hitherto have had to be melted down may be saved, thereby making possible a considerable economy in apiary practice.

The Department of Agriculture has naturally been appealed to for assistance in introducing the practice into this country. Action by the Department has been taken along the lines of instituting experiments; of arranging with the Customs Department a scheme whereby the materials necessary are made available to beekeepers for use if they so desire at a minimum of difficulty and expense; and in endeavouring to seek, through the United States Department of Agriculture, full details of the treatment and confirmatory information as to its efficiency, &c.

A reply to hand from the Bureau of Entomology of the United States Department, although it may be considered generally favourable, suggests caution in recommending further experimental work before a definitely favourable pronouncement can be given. The letter reads as follows:—

Your letter of 26th August, addressed to the Secretary of Agriculture, has been forwarded to this Bureau for reply. The investigation which this Bureau is making on the disinfecting of American foul-brood combs by the use of a formaldehyde-alcohol solution is not yet completed, and no definite statement can be made. We have only recently had opportunity to begin work on this in the apiary, and cannot report on it until next season.

The consensus of opinion of many who have used this process commercially during the season is favourable, only a few reporting non-success, those who have been sterilizing combs in large numbers being most enthusiastic over its use. I believe that a summary of the season's practical results will soon be published in *Gleanings in Bee Culture*.

It would be a mistake, however, if beekeepers should allow themselves to be satisfied with the treatment as it has been worked out. A cheaper and more convenient solution or method for disinfecting combs is much desired in this country, as alcohol is expensive, as well as difficult, for the small beekeeper to secure.

Our information is to the effect that the solution should consist of 20 per cent. formalin and 80 per cent. alcohol. It is advised that grain alcohol and not the ordinary denatured alcohol or wood-alcohol be used.

As soon as we have any suitable data, publicity will be given to them through the bee journals.

SUGAR-BEET TRIALS IN CANTERBURY, SEASON 1923-24.

F. E. WARD, Instructor in Agriculture, Christchurch.

FOR several years past there has been a movement in Canterbury for establishment of the beet-sugar industry. Nothing tangible has yet eventuated regarding the erection of a factory, but small areas of beets have been grown, mainly with the object of demonstrating the suitability of soil and climate. The Department of Agriculture has from time to time imported seed for trial purposes. The last consignment of the variety Wanzelban was received from Australia in the late spring of 1923. As the movement centred chiefly in the Ashburton district last year, a number of plots were tried there as well as in the Kaiapoi district, where the most serious attempts at the establishment of the industry had been made.

Reports have recently been received from growers, and certain crops have been inspected and weighed by officers of the Department. The reports as a whole have indicated an unsatisfactory crop, due almost entirely to the late arrival of the seed and the extreme dryness of the season. The seed was not sown until November, and the rainfall for the ten months from November to August, 1923-24, inclusive, was only 15.79 in. at Ashburton and 16.98 in. at Christchurch. The yield from two farms in the Ashburton district which were above the average was as follows:—

Mr. Harry Brown, Wakanui : Wanzelban variety, sown in November, 1923, at 13 lb. per acre ; width of drills, 28 in. ; manures various ; average yield of topped beets from five plots, 6 tons per acre.

Ashburton Experimental Farm : The following results were obtained from plots receiving different treatments in regard to width of row, manures, &c., the date of sowing being 8th November, 1923 :—

Width of Rows.	Manure.	Plants thinned to	Yield per Acre.
Inches.			Tons.
18	300 lb. super	8 in. apart	11.85
18	No manure	8 in. apart	8.85
18	300 lb. super	1 ft. apart	10.26
28	280 lb. super	1 ft. apart	9.75
28	No manure	1 ft. apart	7.43
28	300 lb. mangold-manure ..	1 ft. apart	7.86

The average yield of four manured plots was equal to 9.93 tons per acre of topped beets.

It seems evident from the observations of this and other seasons that sugar-beet can be sown in closer rows than mangolds. The latter

is usually sown on the ridge in 26 in. or 28 in. rows, while beet should be on the flat in 18 in. or 21 in. drills. The rates of sowing appear to vary considerably in the various sugar-beet-growing countries of the world, and all seem higher than the requirements in New Zealand. From the evidence obtained up to the present, with good seed and favourable conditions, 8 lb. to 10 lb. per acre, in 18 in. or 21 in. drills, should be an ample sowing.



SAMPLES OF SUGAR-BEET GROWN BY MR. H. MCINTOSH, KAIAPOI.

Seed drilled 20/11/23. Photo taken 26/6/24. Scale indicated by foot rule.

A variety trial conducted on the farm of Mr. Hector McIntosh, Kaiapoi, indicated the unsuitability of certain varieties, not from the point of low yield, but from the fact that too large a portion of the beets grew above ground, making them unsuited to sugar-manufacture. The varieties tried were: (1) Wibolth's Danish Improved, (2) Wanzelban, (3) Rose Giant, (4) White Giant. The two first-named varieties were shown to be of suitable type, and the others proved to be unsuitable.

Island Phosphates.—The Department's Chemist, in his last annual report, records the discovery by Mr. F. W. Furkert, Public Works Department, of a deposit of phosphate of aluminium at the Three Kings Islands. Samples contained from 14.81 to 31.55 per cent. of phosphoric anhydride, but no calcium was present. From White Island the Chemist also received a sample of guano containing 1.4 per cent. nitrogen and 7.13 per cent. phosphoric anhydride. This would be worth £2 to £3 per ton after grinding. Both of these island phosphates were evidently derived from bird-dung.

TESTING OF PUREBRED DAIRY COWS.

OCTOBER CERTIFICATE - OF - RECORD LIST.

W. M. SINGLETON, Director of the Dairy Division.

At this season of the year certificates are being issued in large numbers, and the present list contains particulars for 189 cows and heifers. Not only is the list strong numerically, but many good performances are recorded.

Lulala, a junior two-year-old Jersey, with 678.17 lb. butterfat, falls only some 12 lb. below the leader of her class, Alfalfa Pansy. The first three names in the senior two-year-old Jerseys show butterfat yields exceeding 600 lb., and the first four three-year-olds of the same breed have each produced beyond the 700 lb. mark.

In the Friesians appear, among others, Mutual Stella de Kol, a senior two-year-old, with a certificate for 720.43 lb., and Rosevale Catrina Posch, a junior three-year-old, with 679.48 lb.

The outstanding features of the list, however, are the performances of the three-year-old Jersey, Loo's Queen, with 797.32 lb. butterfat, and the senior four-year-old Milking Shorthorn, Matangi May 2nd, with 574.56 lb. Each of these cows has now gained a class-leadership.

Loo's Queen was bred and tested by Mr. A. Christie, Tanekaha, the breeder and owner of Vivandiere, the champion of the breed. The previous leader of the class was Mr. E. Joyce's Zola of Rosy Creek, who gained a certificate of record for 741.20 lb. butterfat, so that Loo's Queen has exceeded this performance by 56.12 lb. Loo's Queen and Vivandiere are half-sisters, Loo being the dam in each case. The sire of Loo's Queen is Jersey Brae's Sea Lord, who on the sire's side goes back three generations to K.C.B., and on the dam's side three generations to Majesty's Fox, which names require no further comment. Well-known females on this side of the pedigree are Avalanche (Fitzwilliam-Snowdrift) and Eileen (Imp.). Loo (dam of Loo's Queen) is by Roberts (Imp.), a well-known Jersey sire, and two generations farther back on the female side K.C.B. appears twice. It would thus appear that the earlier importations into the Dominion are still adding to their reputation for quality and prepotency.

Matangi May 2nd was bred and is owned by Messrs. Ranstead Bros., of Matangi, and her yield of 574.56 lb. butterfat exceeds that of the previous leader, Mr. R. S. Allan's Sweet Garnett 2nd of Cornwall Park, by 60.37 lb. Messrs. Ranstead Bros. now have the enviable distinction of holding six leaderships out of the seven classes into which the Milking Shorthorn breed is subdivided. Matangi May 2nd is sired by Dominion Esau of Ruakura, so that with the exception of Maniaroa Princess the champions from Messrs. Ranstead Bros' farm are all daughters of this bull. The dam of Matangi May 2nd is Matangi Mary, who as a mature cow gained a certificate for 630.49 lb. butterfat.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat reg'd for Cent.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS.						
		Yrs.	dys.	lb.	lb.	lb.
<i>Junior Two-year-old.</i>						
Lulala	R. Dunn, Auroa	2	2	240·7	365	10,210·5 678·17
Penrose Gale ..	J. B. Clemow, Stratford ..	2	11	241·6	365	9,008·7 550·06
Carhuduff Golden Lily	J. O'Donnell, Bunnythorpe	1	360	240·5	365	10,408·5 540·22
Twylsh Thistledown	W. T. Williams, Pukehou ..	1	349	240·5	365	10,399·6 539·95
Wahinepai's Creamy†	E. Joyce, Kaponga	1	342	240·5	365	10,583·0 533·27
Olive's Darling ..	E. Joyce, Kaponga	1	347	240·5	365	10,492·8 529·87
Phalaena	A. H. Elicott, Hamilton N.	2	27	243·2	365	9,200·5 524·33
Elf's La Primevere ..	J. Robb, Westmere	2	27	243·2	364	8,330·6 523·73
Jerseydale Vanity ..	J. Pettigrew, Pihama ..	1	345	240·5	365	6,759·9 513·18
Euretta	M. J. Price, Taonui	1	291	240·5	365	10,378·1 511·99
Llangollen Princess ..	J. T. Entwisle, Cambridge..	2	30	244·1	375	8,331·0 507·75
Celia's Pride	E. Joyce, Kaponga	1	332	240·5	365	8,561·0 505·94
Lady Vance	F. J. Finer, Ngutuwera ..	1	349	240·5	365	9,862·6 503·17
Sunkist's Silver Bell..	P. A. Anderson, Levin ..	2	22	242·7	362	9,166·7 498·12
Volee's Marigold ..	P. A. Anderson, Levin ..	2	40	244·5	365	8,001·4 490·17
Brentwood Treasure..	C. A. Willis, Pukekohe ..	1	332	240·5	365	8,505·5 487·35
Penrose Princess Mary	J. B. Clemow, Stratford ..	1	347	240·5	365	7,618·8 469·15
Tiny Sweet	A. J. Harris, Bombay ..	1	323	240·5	365	7,218·3 469·07
Brooklyn Golden Diana	H. J. Lancaster, Glen Oroua	1	304	240·5	365	7,800·2 468·23
Llangollen Lady ..	J. T. Entwisle, Cambridge	2	15	244·5	365	9,184·6 466·97
Oakvale Dixie	J. H. Street, Bell Block ..	2	9	241·4	365	8,159·8 465·43
Mone's Hope	P. A. Anderson, Levin ..	1	350	240·5	363	8,344·5 460·41
Thornycroft Princess	T. M. Remington, Westmere	2	18	241·3	365	6,614·5 455·81
Cairnhill May Queen	Richmond Bros., Stratford	1	321	240·5	365	8,130·7 447·42
Gold Plane	A. Christie, Tanekaha ..	1	268	240·5	365	9,143·7 444·66
Ohio Bilberry's Eminence	A. H. Guy, Mangatoki ..	1	363	240·5	365	8,787·5 443·61
Ohio Nettie	A. H. Guy, Mangatoki ..	2	34	243·9	365	8,447·0 440·29
Westmere Joyce ..	J. Robb, Westmere	2	33	243·8	365	7,593·5 437·30
Kuranui Myosotis ..	O. Glynn, Morrinsville ..	1	358	240·5	365	7,420·5 433·45
Arthingworth Renata	E. Smallbone, Richmond ..	1	341	240·5	365	7,762·6 431·02
Springburn Volee ..	R. L. Horn, jun., Ohau ..	1	322	240·5	365	8,308·2 430·46
Neat Lassie	F. J. B. Ryburn, Paterangi	1	349	240·5	364	8,108·1 429·61
Waimarie Dulcie ..	H. J. Livingston, Kiwitea	1	341	240·5	365	7,675·7 426·47
Uruti Topsy	W. Oxenham, Uruti	1	349	240·5	365	7,952·5 420·00
Lamorna Lass	S. A. Tippet, Okaiawa ..	1	322	240·5	365	7,156·7 418·23
Thornycroft Beauty ..	T. M. Remington, Westmere	2	31	243·6	360	6,840·1 416·78
Brentwood Favourite	C. A. Willis, Pukekohe ..	1	357	240·5	365	6,179·0 414·82
Maori Rowdy Girl ..	R. C. Powell, Bunnythorpe *	1	356	240·5	355†	7,009·3 412·15
Lovely Eyes	R. Hicks, Hawera	2	48	245·3	326	7,769·5 408·05
Dudu's Farewell ..	G. R. and H. Hutchinson, Auckland	1	318	240·5	365	7,284·3 406·42
Jersey Meadow's Dorothy	P. A. Anderson, Levin ..	2	3	240·8	365	8,664·8 405·55
Quillet	J. J. Scheuber, Hawera ..	1	310	240·5	365	8,681·1 404·64
Abberly Sybil	T. Ranford, Palmerston N.	1	364	240·5	365	7,744·0 401·90
Golden Maiden	H. J. Lancaster, Glen Oroua	2	18	242·3	365	7,029·3 397·89
Duke's Empress	A. C. Sorensen, Eltham ..	1	320	240·5	326	5,921·3 394·92
Pine Bank Ruby	J. Meuli, Normanby	2	10	241·5	353	6,422·8 391·34
Middlewood Darling	H. Beatson, Aorangi	2	12	241·7	365	7,115·0 387·04
Middlewood Ruby ..	H. E. Williams, Tokomaru	2	22	242·7	365	6,986·2 383·02
Hillview Hazel	Hunter Bros., Te Kowhai ..	1	309	240·5	342	7,907·8 347·81
Fleurion	Aickin and McCarroll, Woodhill	1	321	240·5	365	5,871·3 311·47
Burnside Queen Bessie	S. J. Hollard, Rowan ..	2	17	242·2	309	6,861·0 343·78

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—continued.

<i>Junior Two-year-old—continued.</i>		Yrs. dys.	lb.		lb.	lb.
Briarbank Alma K.C.	R. D. Dagg, Kaponga ..	2 15	242·0	352	5,424·5	342·62
Middlewood Jean ..	E. E. Hale, Hamilton ..	1 328	240·5	343	5,568·4	340·45
Chase's Supreme ..	F. P. King, Cambridge ..	1 318	240·5	365	6,059·2	335·11
Mayflower of Bull's ..	F. J. Watson, Bull's ..	2 45	245·0	350	5,381·7	330·97
Holly Bank Lass ..	John Nicolson, Hawera ..	1 338	240·5	300	5,950·5	328·74
Tirohia Silver Spray..	B. E. Veale, Tirohia ..	1 349	240·5	328	7,401·7	318·76
Meadowvale Miss Jelliecoe	C. Meuli, Tariki ..	2 9	241·4	362	5,874·8	316·90
Hillview Famous ..	Aickin and McCarroll, Woodhill	1 317	240·5	365	6,006·6	303·77
Airton Victorine ..	W. H. Waterhouse, Runciman	2 7	241·2	350	5,211·1	296·66
Ferndale Golden Fern	C. Meuli, Tariki ..	2 2	240·7	345	4,717·9	292·83
Huabrook Dovelet ..	W. H. Waterhouse, Runciman	2 18	242·3	313	4,859·6	278·10
Cloverlea Avalanche..	R. J. Morris, Opunake ..	2 18	242·3	289	5,137·5	266·21
Parakau Lulu ..	Aickin and McCarroll, Woodhill	2 21	242·6	284	5,114·7	255·66
Pencarrow's Twylish Charm	A. W. Foulds, Kumeu ..	2 15	242·0	247	4,552·4	251·45

<i>Senior Two-year-old.</i>						
Abberly Stella ..	J. O'Donnell, Bunnythorpe	2 359	276·4	365	10,690·5	656·70
Kuku Glory ..	R. L. Horn, sen., Ohau ..	2 329	273·4	365	12,059·9	633·69
Holly Oak Adeline* ..	W. T. Williams, Pukehou ..	2 334	273·9	365	11,115·0	614·74
Penrose Maid ..	J. B. Clemow, Stratford ..	2 337	274·2	365	9,280·0	579·05
Rockview Lady ..	G. R. and H. Hutchinson, Auckland	2 358	276·3	365	10,161·5	541·83
Penrose Duchess ..	J. B. Clemow, Stratford ..	2 319	272·4	365	8,453·9	506·83
Briar Bank Holly ..	R. D. Dagg, Kaponga ..	2 363	276·8	349	8,326·0	505·45
Lambert's Mollie ..	John Nicolson, Hawera ..	2 347	275·2	357	7,934·5	502·80
Cloverlea Maid ..	D. P. F. Malone, Kaponga..	2 298	270·3	365	8,266·0	499·53
Ethel's Hope† ..	J. McIvor, Ohaupo ..	2 355	276·0	365	8,343·2	498·67
Almadale Silvie ..	Hunter Bros., Te Kowhai ..	2 325	273·0	365	9,213·0	473·64
Trethella Silver Stream	R. L. Horn, jun., Ohau ..	2 306	271·1	365	8,931·3	471·90
Loyalty's Jem ..	W. E. Wickham, Waitara ..	2 359	276·4	365	8,390·0	466·21
Some Girl ..	J. E. Rae, Taneatua ..	2 349	275·4	327	8,324·0	438·93
Makanui Duchess ..	H. G. Livingstone, Kiwitea	2 330	273·5	365	6,262·8	420·40
Noble Gray Girl ..	Robert Wattam, Fencourt..	2 353	275·7	355	7,052·5	400·53
Holly Oak Dewdrop ..	A. C. Sorensen, Eltham ..	2 298	270·3	330	6,361·9	356·95
Reward's Hope ..	J. McIvor, Ohaupo ..	2 338	274·3	332	6,471·2	301·67
Springbank Pet ..	E. S. Holdaway, Ballance ..	2 280	268·5	282	4,823·8	272·43

<i>Three-year-old.</i>						
Loo's Queen ..	A. Christie, Tanekaha ..	3 332	310·2	365	13,422·3	797·32
Trethella Sunlight ..	J. D. Brown, Weraroa ..	3 3	277·3	365	13,726·4	733·29
Indara* ..	F. J. Finer, Ngutuwaera ..	3 350	312·0	365	12,849·0	724·68
Kuku Delightful ..	R. L. Horn, sen., Ohau ..	3 315	308·5	365	12,780·3	715·21
Jersey Meadows Regna	H. H. Phillips, Te Rehunga	3 351	312·1	365	10,455·7	631·62
Kuku Spot ..	R. L. Horn, sen., Ohau ..	3 345	311·5	365	11,720·1	629·50
Melita ..	J. Nicolson, Hawera ..	3 322	309·2	365	11,959·5	584·66
Zaida ..	H. O. Washbourn, Richmond	3 311	308·1	365	11,427·9	571·17
Waitapu Lassie ..	E. Sinclair, Waitapu ..	3 222	299·2	365	11,075·8	555·46
Lady Jose ..	J. J. Scheuber, Hawera ..	3 339	310·9	365	10,675·8	524·39
Shamrock's Tiny ..	E. Bennett, Cardiff ..	3 322	309·2	338	8,059·1	508·25
Rosy Creek Song ..	D. P. F. Malone, Kaponga	3 363	313·3	365	11,040·2	507·61
Jersey Oak's Uni's Lady	G. Milligan, Mangateretere..	3 7	277·7	326	8,656·5	496·33
Jersey Meadows Ivy	H. H. Phillips, Te Rehunga	3 328	309·8	365	8,439·3	485·28
Primrose Jolie ..	A. Buchanan, Palmerston N.	3 49	281·9	365	9,050·2	481·86

LIST OF RECORDS—continued.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cal.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—continued.

<i>Three-year-old—continued.</i>		Yrs. dys.	lb.		lb.	lb.
Kahuwera's Rose ..	J. V. Mortensen, Piopio ..	3 357	312·7	365	9,224·9	451·85
Passion's Beauty ..	J. Robb, Westmere ..	3 342	311·2	365	9,663·0	449·01
Lupin's Beauty ..	G. Milhgan, Mangateretere ..	3 317	308·7	349	9,904·9	446·64
Radiant Sunset ..	G. R. and H. Hutchinson, Auckland ..	3 31	280·1	327	7,210·1	430·25
Fair View Magnet ..	H. Mellow, Kaponga ..	3 20	279·0	294	7,200·7	422·97
Almadale Gem ..	Hunter Bros., Te Kowhai ..	3 23	279·3	332	6,571·7	414·53
Brookley Dairymaid ..	W. Johnson, Ngaere ..	3 10	278·0	259	5,333·8	313·85
Blossom's Hope ..	C. Meuli, Tariki ..	3 293	306·3	359	5,449·9	313·42
<i>Four-year-old.</i>						
Penrose Princess ..	J. B. Clemow, Stratford ..	4 10	314·5	365	10,867·5	619·15
Algoma ..	R. Waterhouse, Papakura ..	4 66	320·1	320	9,555·5	541·48
Armistice K.C. ..	R. D. Dagg, Kaponga ..	4 288	342·3	365	8,971·0	483·75
Illawarra's Floss ..	R. J. Morris, Opunake ..	4 326	346·1	365	8,916·0	469·55
Balla Mona Koi ..	J. Hunt, Richmond ..	4 295	343·0	365	8,261·8	456·45
Belvedere Laurel ..	E. B. Eagle, Greytown ..	4 28	316·3	286	8,203·0	425·21
<i>Mature.</i>						
Kairanga Lady ..	L. A. Lancaster, Kopane ..	6 51	350·0	365	9,969·7	670·66
Utility ..	J. O'Donnell, Bunnythorpe ..	9 323	350·0	365	11,371·8	656·29
Brixton's Queen ..	A. J. Luxton, Omata ..	8 7	350·0	365	11,441·2	622·69
Thistle Chase ..	A. J. Dempsey, Horsham Downs ..	7 218	350·0	365	10,016·3	607·43
Kuku's Princess ..	R. L. Horn, sen., Ohau ..	5 302	350·0	365	12,048·7	605·58
Jersey Brae's French Girl ..	J. T. Entwisle, Cambridge ..	5 284	350·0	365	10,044·4	604·65
Crofton's Dolly ..	A. J. Luxton, Omata ..	5 2	350·0	365	11,243·7	590·43
Abess ..	A. H. Guy, Mangatoki ..	7 332	350·0	310	9,122·9	555·06
Jersey Lea Model Lily ..	S. Bowker, Ihakara ..	7 311	350·0	365	9,381·5	552·65
Willowbank Ability ..	W. Johnson, Ngaere ..	5 363	350·0	360	10,413·1	550·31
Rozel's Cowslip ..	J. B. Clemow, Stratford ..	5 329	350·0	365	10,368·9	549·71
Village Maiden ..	J. Klenner, Kaimata ..	6 3	350·0	361	10,323·5	544·18
Lassy's Daisy ..	Keightley Bros., Waitoa ..	5 298	350·0	365	10,047·1	533·86
Reid Park's Queen Bess ..	C. A. Willis, Pukekohe ..	5 320	350·0	365	10,379·8	529·92
Pick of the Bunch ..	H. H. Buxton, Auroa ..	8 341	350·0	352	11,848·5	524·50
Doris of Bull's ..	M. J. Price, Taonui ..	7 62	350·0	365	10,805·6	517·44
Kilkenny ..	B. G. Doel, Taumarere ..	10 280	350·0	365	10,004·4	507·63
Holly Bloom ..	T. M. Remington, Westmere ..	10 359	350·0	365	8,711·3	501·27
Polly Hinemoa ..	F. P. King, Hautapu ..	7 24	350·0	365	10,192·4	497·63
Holly Bank Bell ..	H. H. Buxton, Auroa ..	9 354	350·0	347	9,520·9	497·60
Sunny's Darling ..	J. Karl, Paterangi ..	5 208	350·0	365	7,576·7	487·29
Hawkesbury Grace ..	C. A. Willis, Pukekohe ..	7 305	350·0	365	8,889·4	486·36
Eminent Rosebud ..	F. P. King, Hautapu ..	5 23	350·0	365	8,828·2	477·05
Rewa Mone ..	P. A. Anderson, Levin ..	6 29	350·0	337	9,000·1	452·40
Grafton Sunset ..	Brakenridge and Pearson, Taupaki ..	5 287	350·0	365	9,073·3	449·99
Caloola Thistle ..	H. H. Buxton, Auroa ..	6 25	350·0	321	8,358·0	435·48
Awatea ..	M. J. Price, Taonui ..	6 215	350·0	303	7,832·8	427·90
Little Charm ..	H. H. Buxton, Auroa ..	8 304	350·0	317	8,872·8	425·75
Queen Soumise ..	A. Thorne, Levin ..	8 12	350·0	365	7,980·4	404·44
Neptune's Daughter ..	C. Meuli, Tariki ..	5 9	350·0	340	6,972·1	367·86
Mauriaena Veronica ..	Aickin and McCarroll, Woodhill ..	5 316	350·0	301	7,251·2	367·18
Burnside's Lassie ..	S. J. Hollard, Rowan ..	5 293	350·0	300	6,256·5	361·49

LIST OF RECORDS—continued.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS.						
<i>Junior Two-year-old.</i>		Yrs. dys.	lb.		lb.	lb.
Rosevale Sylvia Model Keyes*	T. Sherriff, Clandeboye ..	2 160	256.5	365	17,765.7	612.27
Glen Iris Queen Segis*	R. R. Pearson, Rongotea ..	2 35	244.0	365	15,400.5	517.11
Cluny Pietje Kate 11th†	Piri Land Company, Orini..	2 88	249.3	316	9,312.0	309.66
Pretty Maid Alcartra†	S. Andrew, Kaikoura ..	2 8	241.3	365	8,947.4	289.15
Murihiku Topsy† ..	Gibb Bros., Clifton ..	2 26	243.1	294	7,449.0	278.42
<i>Senior Two-year-old.</i>						
Mutual Stella De Kol*	C. R. Duncan and Sons, Whangamarino	2 338	274.3	365	16,624.8	720.43
Colinton Clover Omega*	R. Colee, Greendale ..	2 343	274.8	365	16,461.5	601.30
Mutual Lass of Long-view†	C. R. Duncan and Sons, Whangamarino	2 320	272.5	365	15,371.5	591.07
Ryvington Dorothea*	Hodgson Estate, Tamahere	2 349	275.4	365	14,864.3	558.22
Ryvington Lulu† ..	Hodgson Estate, Tamahere	2 324	272.9	365	15,747.4	557.21
Pareora Ethel Korn-dyke*	A. S. Elworthy, Timaru ..	2 324	272.9	365	1,677.9	514.34
Pareora Cherry Blossom*	A. S. Elworthy, Timaru ..	2 324	272.9	365	14,130.5	491.35
Rosevale Helena Keyes*	McDonald and Co., Dunedin	2 264	266.9	365	15,453.3	471.10
Cluny Hengerveld Rosebud 4th*	Matangi Friesian Farm Company, Matangi	2 236	264.1	365	10,864.0	386.36
Ashlynn 11th* ..	E. F. Peacocke, Hamilton	2 296	270.1	365	9,423.5	332.53
<i>Junior Three-year-old.</i>						
Rosevale Catrina Posch*	H. North and Sons, Omimi	3 88	285.8	365	21,688.2	679.48
Glen Iris Patchwork*	R. R. Pearson, Rongotea ..	3 25	279.5	365	18,351.0	588.55
Princess 2nd of Fairburn†	F. Crump, Springston ..	3 4	277.4	365	15,440.6	481.28
<i>Senior Three-year-old.</i>						
Te Repo Bounty Girl*	R. Colee, Greendale ..	3 189	295.9	365	14,377.6	574.82
Princess Korndyke† ..	W. J. Eames, Livingstone ..	3 191	296.1	365	13,612.5	465.07
<i>Junior Four-year-old.</i>						
Rosevale Sylvia Colantha*	H. North and Sons, Omimi	4 167	330.2	365	18,025.2	651.18
Weston Lea Challenge Soldene*	E. F. Peacocke, Hamilton ..	4 3	313.8	365	11,238.1	452.50
<i>Senior Four-year-old.</i>						
Lady Winana of Woodlyn*	T. C. Barbour, East Tamaki	4 363	349.8	365	17,696.7	527.15
<i>Mature.</i>						
Rosevale Nancy Posch*	H. North and Sons, Omimi. :	5 147	350.0	365	20,563.3	664.98
Tinie Grant 2nd* ..	John Court, Ltd., Auckland	5 21	350.0	365	20,844.8	649.05
Lady St. Eloi* ..	C. R. Duncan and Sons, Whangamarino	7 193	350.0	365	16,356.2	578.48
Zozo 2nd of Ashlynn*	John Court, Ltd., Auckland	7 242	350.0	305	13,322.4	555.44
Princess Van Friesland Park	A. S. Elworthy, Timaru ..	5 298	350.0	365	16,274.6	555.09
Johanna Alcartra* ..	John Court, Ltd., Auckland	5 297	350.0	365	18,139.4	531.18
Weston Lea Belle* ..	E. F. Peacocke, Hamilton	6 28	350.0	365	13,339.3	448.77
Bainfield 27* ..	C. H. Potter, Pukerau ..	6 46	350.0	114	9,594.7	361.48
MILKING SHORTHORNS.						
<i>Senior Three-year-old.</i>						
Matangi Jewel 2nd† ..	Ranstead Bros., Matangi ..	3 362	313.2	365	12,480.4	561.57
Matangi Lily 3rd† ..	Ranstead Bros., Matangi ..	3 358	312.8	325	12,766.1	561.13

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
MILKING SHORTHORNS— <i>continued.</i>						
<i>Senior Four-year-old.</i>		Yrs. dys.	lb.		lb.	lb.
Matangi May 2nd* ..	Ranstead Bros., Matangi ..	4 364	349·9	365	13,640·8	574·56
<i>Mature.</i>						
Pukekite Rangit† ..	R. King, Buckland ..	Mature	350·0	365	12,901·8	605·29
Eleam Ruth† ..	Hanson Bros., Parakai ..	8 311	350·0	331	12,169·0	458·42
Braeside Parisian Diamond†	Hanson Bros., Parakai ..	Mature	350·0	356	10,503·4	425·79
AYRSHIRES.						
<i>Two-year-old.</i>						
Jean 2nd of Carmel Glen†	A. W. Foulds, Kumeu ..	1 354	240·5	327	7,531·6	307·86
Belle of Earlstoun ..	R. Marshall, Runciman ..	2 44	244·9	365	6,329·8	289·81
Trixie of Carmel Glen†	A. W. Foulds, Kumeu ..	1 355	240·5	363	6,350·0	259·86
Joan of Earlstoun ..	R. Marshall, Runciman ..	2 30	244·1	358	6,146·5	258·68
<i>Three-year-old.</i>						
Isobel of Ashleigh Park†	C. B. Morgan, Ngawapurua	3 290	306·0	365	12,463·2	528·47
<i>Second-class Certificates.</i>						
JERSEYS.						
<i>Three-year-old.</i>						
Maori Pulchra ..	A. G. Somervell, Takapau	3 295	306·5	365	8,255·9	519·29
FRIESIANS.						
<i>Junior Four-year-old.</i>						
Friesland Model Maid*	A. S. Elworthy, Timaru ..	4 152	328·7	365	13,668·5	394·76



OAKLAND'S GUERNSEY (F. W. CORNWAIL, BELL BLOCK).

C.O.R., 1923, in Jersey three-year-old class: 10,565·3 lb. milk, 692·54 lb. butterfat.

SEASONAL NOTES.

THE FARM.

HAYMAKING.

IN December haymaking will become general. Meadow hay should be cut when the predominant varieties of grasses are in flower—that is, technically expressed, when the anthers are protruding from between the chaff-scales. The weight of herbage and the digestible nutrients will then be at about their maximum. The distribution of the nutrient material is also fairly uniform, whereas at a later stage a transference of much of this material to the developing seeds takes place, and the stem becomes fibrous and indigestible. A little loss in weight owing to an early start is generally more than counterbalanced by the superior feeding-qualities of the crop. Moreover, the earlier the crop can be removed the better the aftermath. Hay should not be allowed to get too dry before being raked into rows or put up in cocks. Gradual drying is much to be preferred to baking, which is likely to ensue if the crop is left spread over the ground during very hot weather.

Many farmers experience difficulty in saving lucerne, tare, or clover hay in good condition. All legumes require more “making” than do the grasses, and suffer more from the wetting, drying, and handling that prolonged haymaking in a changeable climate entails. A good practice is to gather the hay into big cocks when it is still half made, generally on the second day after cutting. These cocks should be about a couple of dray-loads in size, and must be carefully built and raked down so as to turn any rain. In them the hay will sweat considerably, but, being comparatively small in volume, little harm will result. They may be left standing, if necessary, for several weeks, but are usually fit to stack by the end of ten days. They may be drawn to the stack by a chain passed round them, but care must then be taken that any stones and dirt are shaken out of the bottom layer before it is pitched up to the stack. A slower but rather better method is to load them on to drays.

In the case of cereals intended for hay, the best stage for cutting is when the straw is still green and the grain is just getting into the dough stage.

ENSILAGE.

Ensilage should have more recognition in this country as a valuable stand-by in case of the failure of root crops, green fodders, or pastures. It can be readily made from surplus grass, lucerne, cereals, and tares or peas, &c., especially when weather conditions are against haymaking. For the stack method a site with good drainage should be selected, and sufficient material cut and carted to build 6 ft. or 8 ft. the first day. This should be allowed to stand until it attains a temperature of at least 130°, but at no time more than 150° F. The building-up of more material is then continued from time to time, as heat is generated in each successive layer. After the first layer it should be only a few feet, until completion of the stack, which may be eventually about 18 ft. or 20 ft. high. The stack should be as nearly square as possible,

and the smallest size not less than 14 ft. by 14 ft., which would provide about 40 tons of material. Salt at the rate of about 6 lb. per ton of green material should be used. When the last layer has reached the required temperature the stack is covered with soil about 18 in. thick, this preventing a further rise in temperature. The stack will settle down very considerably from day to day while being built. If a wind on one side should cause uneven settling, a tarpaulin can be hung on the weather side. The sides should be kept as tight as possible in building, and perpendicular, and the heart level or slightly below the outer tiers. From 40 lb. to 45 lb. of ensilage is a sufficient daily ration for an average cow, and a cubic foot of the material weighs from 40 lb. to 50 lb. according to quality.

ROOT CROPS.

In most districts swedes may be sown during the whole of December, and the best results are often obtained from sowings in the last week of the month. Further sowings of soft turnips for cow-feeding and lamb-fattening should be made. Hardy or Imperial Green Globe are among the best for cows, and are also excellent for lamb-fattening. For later feeding for hoggets, and to take the place of swedes, Green-top Aberdeen (or "Green-top Scotch," as they are frequently called) are very suitable.

Early-sown mangold crops will now be ready for thinning and intercultivation, and careful work will be amply repaid by increase in yield. From 9 in. to 12 in. apart is common for singling, but the Globe varieties generally require a little more space than the Long Reds or Tankards, and up to 15 in. apart will not be too great a distance for plants in good land. The earth should be drawn well away from the remaining plants. Where germination has been patchy it is usual to fill in the gaps by transplanting, and in such cases it is wise to mix a little fresh fertilizer with the soil. A dressing of 1 cwt. to 2 cwt. of nitrate of soda or sulphate of ammonia has in many cases been found to give excellent results if the crop is inclined to be backward and poor in colour. These fertilizers should be applied when conditions are damp.

Carrots will also require thinning—to about 6 in.—and intercultivation. Short varieties, such as the Guerande, which are principally grown for sheep-feed, are an exception as regards thinning, but the usual work with the horse-hoe is necessary.

POTATOES.

Main-crop varieties will require intercultivation and moulding. The maintenance of a soil mulch helps in the conservation of moisture, which normally becomes an important factor towards the end of the year.

In many districts potato varieties have become badly mixed. There are splendid foundation lines available to farmers in different parts, and an effort should be made to rogue fields so as to work into good pure lines. There have been extensive inquiries for pure lines during the spring.

GREEN FORAGES.

Sowings of rape may be continued for another month or two, especially where late lambs and old ewes require to be fattened.

Successional sowings of maize and millet for late summer and autumn feeding may be continued as detailed last month.

Winter forage crops, such as chou moellier and thousand-headed kale, are generally sown before the middle of December in the South. The fact that chou moellier will grow successfully on club-root-infected soil is of great importance. The seed should be ridged in, and eventually thinned out with either the hand- or horse-hoe. The land intended for such forage crops should be well worked, so as to encourage rapid growth.

SUMMER FALLOWING.

Under Canterbury conditions land that is being summer-fallowed with the object of weed-control should be kept stirred during the dry period generally experienced in midsummer. A successful fallow of twitch-infested land necessitates cultivation at sufficiently frequent intervals to prevent any appearance of greenness. As soon as the green leaves appear the plant commences to store food in the underground stems (commonly called "roots"), and it will use up this food reserve in its endeavour to get its green shoots above ground. On cultivated land Californian thistle has been eradicated successfully in one season by constant cutting off just below the ground with sharp broad-tined cultivators. When patches of the thistle are small a little care may save much expense and trouble later.

Old pasture paddocks may be ploughed up at this time of the year, worked thoroughly, and fallowed through the summer in preparation for the sowing of cereal crops in the autumn.

PASTURE-MANAGEMENT.

At the present time of flush pastures it is sound practice to confine stock as far as possible to limited areas, and to move them at frequent intervals as soon as they have grazed the paddock closely, rather than to allow large areas to be semi-grazed. The paddock should then be harrowed and shut up for a few days.

In the North *paspalum* pastures that show signs of getting ahead of the stock should be mown during December so that they may produce fresh feed for any dry spell in January and February.

—*Fields Division.*

THE ORCHARD.

VIGILANCE FOR BLACK-SPOT, ETC.

It is necessary to be always on the lookout at this season of the year for attacks of black-spot on apples and pears. The spray-pump should be kept in readiness for any emergency. Reports indicate that showery weather has been fairly general in most districts. Pasture land and root crops will benefit, but if these conditions continue fungus diseases of all kinds will be in evidence. Should showery weather continue it will be advisable not to move the soil by way of cultivation as this may bring any fungus-spores to the surface, and thereby cause severe infection which may do extensive damage before it is checked. It is much easier to prevent disease than to cure it.

Where brown-rot has been prevalent on stone-fruits in past seasons a careful watch should be kept for any appearance of it. The trees should be sprayed with lime-sulphur, 1-125, plus 4 lb. to 6 lb. of atomic or atomized sulphur.

If pear-slug makes its appearance on plums and cherries the trees should be sprayed with hellebore powder, using $\frac{1}{2}$ oz. per gallon of water. Some varieties of plums drop their fruit badly if sprayed with arsenate of lead.

MARKETING OF STONE-FRUIT.

The season is now approaching when the early varieties of stone-fruit will be reaching maturity. Every endeavour should be made to place fruit on the market in an attractive manner; appearance is becoming a more important factor each season. An honest pack, sound, evenly graded, well-coloured fruit, and clean, new, and neatly stencilled packages are all factors which attract the attention of buyers in these days. Quality also plays an important part and must not be overlooked. The desire to obtain high prices is a great temptation to place immature fruit on the market, but it is a practice that cannot be recommended, as owing to inferior quality it may eventually reflect adversely on prices obtaining later in the season. Fruit should be allowed to reach that stage of maturity when, after being consumed, it will create a further demand. The public is becoming more and more critical with reference to quality as well as appearance. All fruit does not mature and ripen together; therefore it is necessary to make several pickings. Choice peaches for dessert will always pay for being packed in trays and sent to the market in crates, buyers usually being very eager for this class of fruit.

REMOVING FRUIT FROM APPLE-LEADER GROWTH.

Some varieties of apples blossom freely on the young leaders, and where these blooms have set no time should be lost in removing the young fruit, otherwise it will greatly interfere with the leader-growth. For want of care in this respect much damage is often caused, and many trees become unsightly, and leaders weakened. The Jonathan is an example of this, and should be watched always for such weakness.

—*L. Paynter, Orchard Instructor, Christchurch.*

CITRUS-CULTURE.

The continuance of efficient cultivation in the groves, together with the spray applications as recommended in last month's notes, are the chief operations at the present time.

FIREBLIGHT.

During the coming month, and in particular the first half, is the period during which any infection by fireblight may be expected to take place. The necessity for prompt action on the part of orchardists in regard to this matter has previously been pointed out, and it is only necessary now to repeat the request that growers should immediately communicate with the nearest Orchard Instructor upon identification of suspicious symptoms on any trees in their district that come under their notice.

MARKETING OF SMALL-FRUIT.

The attention of strawberry-growers in particular is drawn to the regulations recently gazetted as to the packing of fruit, with a view

to bringing about a better state of affairs on the market in this regard than has hitherto been the case. The regulations were summarized in last month's *Journal* (page 288) for the information of growers of strawberries, loganberries, raspberries, and cherries generally. It is the intention of the Department to put these regulations into force immediately, and inspection of consignments coming forward to the market from time to time will be carried out henceforward.

—J. W. Collard, Orchard Instructor, Auckland.

POULTRY-KEEPING.

DISPOSING OF THE COCKERELS.

DECEMBER brings a busy time for the poultry-keeper, for, with the hatching season over, the housing and run accommodation will be taxed to the utmost. Not only this, but with the young birds gradually developing and demanding more space there is the risk of overcrowding and its consequent evil effects. To prevent this I would urge the necessity of feeding and managing all surplus cockerels to the best advantage, and marketing them immediately they attain the age of four and a half to five months. If cockerels are kept beyond this age they commence to produce their second feathers and thereby fail to put on flesh. If any money is to be made out of a cockerel it must be marketed in a prime condition before the second-feather period. The great point, however, in marketing early is that accommodation is saved, an effect which is distinctly in favour of the remaining stock, while more time is available to attend to the main function of the plant.

If cockerels are to put on a maximum of flesh in a minimum of time they must be separated from the pullets before they commence to crow. They should also have their exercise curtailed, as too much exercise is all against rapid flesh-production. It is also essential that they be housed in quarters that are free from vermin. It is a weak policy to try and prime cockerels on inferior or damaged foodstuffs. If the most profit is to be made from them the food supplied should be sound and fed with a free hand. A suitable morning mash may be made from two parts bran and one part each of finely ground wheat-meal and maize-meal, the whole being mixed with milk or soup into a crumbly mass. Feed three times a day as much as all the birds will eat up clean. Succulent green material should be fed in abundance but separately, and when skim-milk is available it may be given in large quantities to drink.

GREEN FOOD.

Every effort should now be made to provide an abundant supply of green material for autumn and winter use. In view of the present high cost of grain foods, the one and only way of reducing the food bill is to provide a considerable amount of green material in the daily ration. It not only means a saving of the more costly foods, but it also keeps the birds in a healthy thriving state, a condition which is imperative if the flocks are to produce to their fullest

capacity. Poultry-keepers with a patch of lucerne or clover established have a valuable asset in this respect. If these are cut during a succulent stage and finely chaffed they provide an excellent green food during the greater part of the year. In addition, when properly cured the dry chaff (when softened by steaming or boiling if fed by itself or mixed with the morning mash) will be relished by birds of all ages once they become accustomed to it. Silver-beet is another excellent thing to grow for poultry, and is a heavy cropper. Cabbage, kale, rape, and green oats may also be grown to advantage. I would again emphasize that for the young stock to prove really profitable layers they must never receive a setback, and one of the most common checks to healthy development is lack of green food during the growing stage.

TURKEYS.

Turkey-rearing can be made a profitable side line on farms where the conditions are favourable and the birds are properly managed. Turkeys do best on fairly high country that grows short tussock, grass, &c. On low-lying heavy damp ground it will generally be found a difficult matter to rear the young stock, especially where there is a heavy growth of grass. Having suitable soil and a generally favourable environment, the next important matter is to see that the breeding-stock possess strong constitutional vigour. This can be maintained only by frequent introductions of fresh blood, and by the birds being allowed to follow their natural instincts—living in the open and securing plenty of exercise and natural food. It is seldom or never that success is attained under confined conditions, nor will turkeys thrive when running with fowls or ducks.

A common mistake made in the management of turkeys is to use all members of the flock for breeding purposes. If a vigorous strain is to be built up and maintained none but the strongest specimens should be bred from. Before the breeding season arrives any small weak specimens of either sex should be weeded out. If these are bred from it means that the stock will become less vigorous each year. Constitutional vigour is undoubtedly the base on which the successful rearing of turkeys rests, and it must be maintained to the highest degree possible in order that they may have the power to resist the many troubles and diseases to which they are subject. It is necessary that a fresh male from an unrelated strain be introduced at least every third season. Turkeys do not mature till they are from two to three years old. It is therefore a mistake to breed from first-season birds, as these seldom or never produce vigorous progeny.

Turkey-eggs take about twenty-eight days to hatch, and usually fifteen to seventeen eggs are sufficient for the hen to brood properly. A good plan is to put six or seven eggs under an ordinary hen on the same day as the turkey is set, giving the whole to the turkey when hatched out. When setting a turkey use a large bottomless box; place this on the ground, and fill up for about 4 in. above ground-level with fine moist earth. This should be hollowed out in the centre, and made saucer-shaped. Fine hay, oat-straw, &c., are suitable for lining the nest. Care must be taken that the bottom of the nest is made more or less flat, so that the hen can turn the eggs without their rolling on top of each other and getting broken. On the seventh day the eggs should be tested for fertility and the infertile ones removed.

When the turkey hen commences to sit she should be disturbed as little as possible. It is a good plan to have food and water close by, so that she can come off to feed and drink when she pleases. One of the chief secrets in rearing young turkeys is to keep them free from vermin, and to guard against these the sitting turkey should be well dusted with insect-powder before she is set, and again before the pipping-stage. She should not be dusted when the chickens are very young, as the powder may get into their eyes and cause blindness.

After the chicks are hatched the hen and her brood should not be disturbed for at least twenty-four hours. They should then be placed in a large open-fronted, slatted, watertight coop that is free from draught. For the first two days both the hen and her chicks should be confined in the coop, and during the next week the mother should be kept confined, and the coop arranged in such a way that the young ones can have their liberty. In this way they will be encouraged to take exercise, an essential for their welfare. Where possible the coop should be placed on fresh, clean ground, as it is merely courting disaster to try and rear young turkeys on tainted soil. Some people tether the mother hen by the leg and remove her daily on to fresh ground. After ten days, providing the grass is not overlong and the weather is favourable, the hen and her brood can be given free range. Where there is long grass, and especially during wet weather or in the early morning when it is laden with dew, the amount of exercising-space should be curtailed, or the mortality will be great. The mother hen can be depended upon to protect her young during heavy rain, but if they are later trailed through long wet grass they mostly die.

Young turkeys commence to "shoot the red" when from eight to ten weeks old. This period is one of the most critical of their lives, and the only safe course to prevent losses is to provide natural conditions to the highest degree possible. At this stage the birds should be fed well away from the homestead in order to induce them to take a maximum amount of exercise. They should also be encouraged to perch, preferably in trees. It is a mistake to allow turkeys to sleep in houses, except perhaps in a high open-fronted shed. The average fowlhouse found on farms is nothing short of a death-trap where turkeys are concerned.

For the first few days after hatching the young birds should be given stale bread soaked in milk and then squeezed dry, in which some hard-boiled egg has been mixed. As a change they can have rice that has been boiled in milk. As the birds develop they may be given a mash made of finely ground wheat, bran, maize-meal, and oatmeal. The food must be mixed to a dry consistency. Young turkey chicks are always slow to take food, and it is a mistake to try and force them to eat. They have small crops, and require to be fed frequently, but only a little at a time. Overfeeding during the early stages is a common cause of bowel trouble and mortality. Clean water or milk should be given from the outset, and left before the birds at all times, while an ample supply of grit is essential for both old and young stock. Finely chopped green-stuff such as lettuce, young onions, or dandelion-leaves should be fed daily. Charcoal is also good for turkeys, and should be freely provided to birds of all ages.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

NUCLEUS HIVES.

DURING the summer months every attention should be paid to raising a stock of young queens to replace old and failing ones. To buy new queens each successive season is too expensive, and with a little attention and care good queens can be raised by the beekeeper in his own yard. An apiary should be requeened each year, and queens should not be tolerated for more than two seasons at the most. In the long-run it is the queens that tell in the production of big crops, and unless the beekeeper takes the trouble to requeen in the summer only a small proportion of the stocks will yield a surplus.

In order to facilitate the work of queen-rearing a few nucleus colonies should be run in conjunction with every apiary. In these small colonies queens can be raised and cared for until they are mated and laying. It is an easy matter, once the queens are laying, to transfer them to the larger hives in the apiary. Perhaps no branch of apiculture receives less attention than the production of young queens; and yet if the beekeepers who get the big crops of honey are asked what counts most in their production the reply is invariably "young queens." In New Zealand it has been proved over and over again that the best months for raising queens are from November to January. During this period everything is favourable for the operation, as the hives are at their highest state of prosperity. Under normal conditions the workers and drones are at their best, this being the swarming-period.

The best style of nucleus hives to adopt is the four-frame one. This size will give the young queen a chance to lay once she is mated, and will, besides, hold sufficient bees to care for relays of queen-cells throughout the season. To form a nucleus colony take one frame of well-capped brood with adhering bees, and one frame containing honey and pollen, the remaining space being filled with an empty comb and feeder. If the number of bees on the comb is not sufficient to form a good cluster, one or two frames of young bees may be shaken into the nucleus, this being done to replace the field-bees which return to the old hive. Place the frame of brood in the middle of the hive and close the entrance until the following day, when the bees may be released. In the course of a day or two the small colony will settle down, and will then be ready*to receive the first queen-cell.

No better plan can be followed by the beginner than to utilize queen-cells produced naturally—that is, under the swarming impulse. In removing cells from the hives select the largest and most corrugated ones, and cut well into the combs so as not to injure the queens. Care must be taken not to shake the combs containing the queen-cells, as the sudden jolt jerks the larva from its base and the embryo queen will be destroyed. Before inserting the cell in the nucleus hive be sure and examine the comb, in case eggs were transferred with the frame of brood. Should queen-cells be found, destroy these, and the cell can then be grafted with safety. A hairpin makes an excellent tool for holding the cell in position. If the weather conditions are favourable the queen should be laying within a week

after hatching, and when eggs appear in the hive the beekeeper may conclude that she is safely mated. Leave the queen in the nucleus hive until she has proved her laying-capacity, when she may be taken to replace an old or failing one in the apiary. If more queen-cells are available, which is almost certain to be the case where swarming is in full swing, a ripe one may be inserted to take the place of the young queen, and this can be repeated at intervals until the necessary number of queens is raised.

It must be left to the beekeeper to regulate the number of nucleus hives he requires, this depending upon the number of queens to be raised. There are several methods of artificial queen-raising, and details of these can be obtained from text-books on the subject.

FOUL-BROOD.

Nothing retards successful beekeeping more than the ravages of foul-brood, and if bees are to become profitable every effort must be concentrated on the eradication of this disease. As advised previously, the beekeeper should familiarize himself with the symptoms, so that he can detect the appearance of the disease in its early stages. No set time can be given for its treatment, but it may be carried out as soon as settled weather sets in and when nectar is being freely gathered. There are many methods of treating the disease, but none is so effective as the McEvoy plan. Some of the systems practised are extremely dangerous in the hands of the beginner, and he will be wise if he keeps to the McEvoy treatment, which is the best and safest method practised. When treating a colony there should be sufficient bees to form an average-sized swarm. If, however, disease has reduced the colony until there is only a small cluster of bees left, it is advisable to destroy the colony, and remove all infected combs and the hive to a place of safety until such time as it can be properly cleansed. Full particulars for the treatment of foul-brood are contained in the Department's Bulletin No. 1, which can be obtained free on application.

A word of caution may be given to the beekeeper in whose colonies disease reappears after treatment. Many beekeepers resort to cutting out the infected cells, and even some text-books advocate this dangerous practice, but it is only tinkering with the disease. Such advice is misleading, and is certainly not effective in eradicating the trouble. When diseased cells reappear after treatment by far the safest plan is to make use of a modified form of the McEvoy method. In place of shaking the bees on to strips of foundation or "starters" for four days, the bees are shaken on to nine sheets of foundation and an empty "bone-dry" comb, this being inserted in the centre of the hive. At the end of twenty-four hours the comb can be removed, and a frame containing a sheet of foundation put in its place. This operation should be performed quietly and quickly, with the use of very little smoke. The object of inserting the dry comb in the centre of the hive is to induce the bees to store the honey which they took from the diseased hive when shaken. When removing the comb this diseased honey is also removed. If carried out with care this treatment will be entirely successful.

STIMULATIVE FEEDING.

As advised previously, a constant watch must be kept on the stores in the hive. During the flow from the willows and fruit-bloom brood-rearing is increased enormously, and the stores will rapidly dwindle during the period that follows. In order to keep up the strength of the colonies after the cessation of the fruit-bloom artificial feeding should be resorted to until the beekeeper is certain that the clover is yielding nectar. In most districts there is a distinct break between the spring blossom and the clover, and it is not uncommon to find populous hives on the verge of starvation. Hives that are gently stimulated will respond to the treatment and be in good order to work the main clover crop.

The quantity of syrup to be fed will depend largely upon the strength of the hives. If stimulative feeding has to be resorted to, sugar syrup may be fed in a less concentrated form than that which is given in the autumn and spring months, the quantity of water being increased. A syrup fed in the proportion of one of sugar to six of water is all that is required to stimulate the bees and prevent starvation, and will be the means of keeping the colonies strong in brood and bees. It must be remembered that it is strong colonies which count in a flow, and no others should be tolerated during the busy season.

—E. A. Earp, *Senior Apiary Instructor.*

THE GARDEN.

PESTS AND DISEASES.

THE best protection for plants from ills to which they are heir is a suitable environment and generous, skilful treatment; little else is usually required to return an abundant crop. Such conditions secure a strong plant of true type which will resist disease and outgrow the attack of insects. Occasionally, however, under these conditions troubles arise, and under less advantageous circumstances they are sometimes serious, so that a gardener is wise to have a few remedies at hand in case of need. Quiet observation occasionally will detect that need as soon as it arises—will, indeed, often anticipate it and ward off loss and disappointment.

Caterpillars of kinds—especially that known as the “leaf-roller”—do a great deal of damage to foliage and fruit. Foliage thus spoiled cannot fulfil its function, and the plant is checked in its growth. Should this trouble appear during a dry spell the consequences will be serious unless a remedy is applied. We have a great advantage over the last generation of growers in having such a sure remedy as arsenate of lead for this purpose. Two ounces of this paste (or 1 oz. if in powder form) gradually worked into a thin cream and then mixed with 4 gallons of water and sprayed on the plants is certain defeat for such enemies.

Most plants have a special variety of lice (aphids) which only require favourable conditions in the way of weather or a weakened

plant to demonstrate their wonderful fecundity, and by feeding on the juices of the plant, which they suck up, stop its growth. In a dry season cabbage and broccoli plants are specially susceptible. The insects will be found on the backs of the leaves where the elaborated sap can be reached, and the choicest varieties receive their special attention.

Before putting out plants they should be carefully examined, and, if necessary, first dipped in a suitable wash. Many proprietary washes are sold for this purpose. One of the most popular is a nicotine concentrate, 3 teaspoonfuls of which in 4 gallons of water will effectually cleanse the plants. Two ounces of common soap dissolved in the water first makes a more effective mixture. This wash forms an efficient spray for insects of this class on any kind of plant during the growing-period.

Another set of conditions readily cause certain fungus troubles to become epidemic at this season of the year, and the wary grower is on his guard against onion-mildew, potato late blight, and leaf-spot of kinds in raspberry, currant, gooseberry, and strawberry gardens, which may, gradually or suddenly, cause wholesale losses. Such growers should have supplies of bluestone and lime, also lime-sulphur concentrate, at hand, and deal with the difficulty as it arises. The best protection, however, is that first mentioned, and sprays cannot be entirely satisfactory without them.

POTATOES.

Potato crops in this country are too often sadly mixed in the way of variety, or composed of declining strains. Until certificated seed can be obtained the growers of moderate areas would act wisely if they carefully rogued their plots when the plants are in full flower and growth. Study carefully the true type of the variety grown, and dig up at once and dispose of all plants that depart from it in any respect. From the remainder, when mature, seed (sets) may be selected, but even these should be picked over, and any departure from the true tuber type should be discarded. The improvement in the quality and quantity of future crops would amply repay the trouble taken. As a half-measure, the method of marking rogue plants with a stick in the ground beside them, and when harvesting the crop digging them first and keeping that portion of the crop carefully separate for table use, while selecting seed from the remainder, can be recommended as an alternative.

VEGETABLE-CULTURE.

Most of the main crops will now be fairly started and have taken charge of the land allotted them. The preparation of the ground for winter crops should now be brought to a conclusion. Brussels sprouts, broccoli, savoy cabbage, and kale, celery, and leeks form an important section in the food-supply during the winter months. They are all alike in requiring good rich land, and usually form a class of their own in crop rotation, the remains of the heavy manuring applied on their behalf suiting admirably the more delicate requirements of the root crops that follow.

Celery and leeks may be planted out as soon as the plants are ready. For celery, the trenches should run north and south, and be 4 ft. from centre to centre for single rows; wider trenches for two or more rows are sometimes made. In the bottom a quantity of good soil must be placed, together with about an equal quantity of the old hotbeds or similar material. When it has settled down the plants can be put in 6 in., or 8 in. apart. Water the plants the day before lifting, and lift them with a trowel with roots intact. Solid, nutty sticks can only be secured by growing these plants without a check.

Leeks are usually planted in a shallow trench about the same distance apart. Shorten the leaves a little, and with a dibber put the plants in deep, but refrain from firming them.

For the other plants mentioned the land must be ready towards the end of December.

TOMATOES.

The grower of tomatoes under glass will now be settling down in earnest harvesting his crop, with the busy Christmas demand ahead of him. While the packing of many growers is excellent, there are a number who do not appreciate the importance of a neat, smart appearance in the package. The ideal of standard packages may still be some distance in the future, but more should be done in the way of approximate sizing and systematic packing.

It may appear difficult, slow, and tedious, but the experience of packing other fruit in this way is that after a little practice it is really quicker than a random pack that has to be fitted. The matter of maturity is another important point that is sometimes overlooked. The high prices for early fruit may tempt one to pick the plants rather bare, but such action is a mistake, as green immature fruit can never be satisfactory and will soon create a feeling of distrust on the market. The fruit must be mature even if not coloured. It can be identified by a slight change in the green colour, and more readily by cutting one or two fruits in two. The earliest pickings in small establishments do not permit of much classification, but every opportunity should be taken of grading the fruit for maturity. Call the grades "Mature," "Pink," and "Ripe," or what-not; the point is to observe carefully that the grades are kept separate. Mixed grades in fruit-packing are the cause of great loss and anxiety in retail stores, and they should be avoided as much as possible.

THE BERRY HARVEST.

The berry harvest also is at its height. The growers of the popular strawberries, raspberries, and currants will have long and busy days for a few weeks. In districts where the production is large there are possibilities of a congested market owing to the slackening demand from the jam-factories, but the popularity of this fruit is sufficiently great to easily absorb the crop if it is suitably packed and transported promptly. The season for these berries is short, and the fruit is very perishable, but effective advertising and a daily transport service will easily clear this crop of choice delicacies. Here are two points on which the berry-growers' associations may render valuable service.

TOBACCO-GROWING.

The tobacco crop will now be well established, and every attention should be given it in order to secure steady uninterrupted growth, or, in other words, a large crop of sound leaves of the right type and size. Quality in the work will put quality into the leaf, and on this the price depends. It will be remembered that the early harvest of last season gave a wonderfully improved cure, and efforts should be made to maintain this advantage. Harvested in bright, dry, warm weather the leaves possess those gums and oils on which their aromatic qualities depend. The warm, dry atmosphere also facilitates curing.

There are two systems of curing operating in this country—flue curing and air curing. The former requires a suitable shed with small brick furnaces on the outside of the building, the heat from them being carried round the lower part of the interior through large sheet-iron flues. By this method the popular yellow tobaccos of the present day are cured.

Air curing, however, is the method in more general use. For this purpose the ideal building is rather high, with large doors to facilitate loading and unloading, and ample ventilation in the roof, and sides that can be closed or opened. The principles underlying the process are the proper manipulation of temperature, humidity, and draught. Inside, posts are erected which carry tier poles 4 ft. apart and one above another at a distance of about 4 ft. On these the 4 ft. curing-sticks rest when loaded. Many growers will have to adapt for the present season such buildings as exist on the farm. This will require considerable planning and occupy some time to carry out, and should be taken in hand without delay. Too often a good crop is heavily depreciated by bad handling, due to lack of such preparation. Efforts to cure the leaf on stages in the open has been a failure, and valuable leaf was wasted last season in the attempt. The wind and rain experienced during the autumn months resulted in a bruised, washed-out condition that rendered the leaf useless.

—W. C. Hyde, *Horticulturist*.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 18th September to 16th October, 1924, include the following of agricultural interest:—

No. 50816: Shearing-machine; A. M. Kobiolke, Gilderoy, Victoria.
 No. 50819: Milking-machine pulsator; G. J. G. Fraser, Otautau. No. 52252: Milking-machine; N. J. Daysh, Palmerston North. No. 52520: Inflation and teat-cup protector; M. J. O'Connell, Clandeboye. No. 50750: Cream-separator; A. H. Wilkinson, Busselton, West Australia. No. 60917: Teat-cup; L. B. Dougherty, Hamilton East. No. 52450: Seed and fertilizer spreader; W. Lyons, Roseberry East, Victoria. No. 52451: Sheep-shearing machine driving-means; L. McLachlan, Longreach, Queensland. No. 50468: Milk measuring and sampling means; C. M. Stanley and J. H. Stuart, Apiti. No. 51376: Milking-machine teat-cup suction cut-off; W. A. Shields, Sydney, N.S.W. No. 52489: Milking-machine teat-cup; J. G. Lamb, Melbourne. No. 52560: Incubator; Anderson and Entinap Proprietary, Prahran, Victoria.

Copy of full specifications and drawings in respect to any of the above may be obtained from the Registrar of Patents, Wellington; price 1s.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

DROPSICAL SWELLINGS IN HORSE.

C. K. WATKINS, Kaiwaka :—

About three months ago I noticed that the sheath of one of my horses was swollen up to more than double its natural size, and with this a soft swelling about 8 in. long, 4 in. wide, and 2 in. deep along the under part of his stomach. I turned the horse out, but he has been losing condition ever since. Could you suggest a cure?

The Live-stock Division :—

Dropsical swellings of the sheath and abdomen frequently occur in horses badly infested with worms. Under the circumstances, seeing that the horse is losing condition, a liberal amount of nourishing feed should be given. A mash of bran twice daily, with an occasional feed of crushed oats, also a few pounds of linseed boiled into a jelly, and a cupful of this mixed with the feed two or three times weekly will prove beneficial. Medicinally, you might try the effect of the following powder given mixed in the food once daily (chemist will make up a dozen powders): Powdered arsenic, 2 grains; carbonate of iron, 1 dram; nux vomica, 1 dram; gentian, $\frac{1}{2}$ ounce; powdered aniseed, 1 dram. It is advisable to cleanse the sheath with warm water and softsoap. Also, warm fomentations to the swelling might help.

RIDDING LAND OF RATSTAIL.

W. McLEAN, Otoko :—

What is the best way to get rid of ratstail—a very thick sward—on easy to fairly steep hills, ploughable? It does not turn over well with an ordinary double-furrow plough. Would a hillside disk or a strong heavy hillside swing-plough be better?

The Fields Division :—

A heavy growth of ratstail forms one of the most difficult swards to deal with. It is generally considered that one ploughing is not sufficient to make a good job. The type of plough likely to give the most satisfaction is one with a long mouldboard and fitted with an adjustable undercutting skeith. This attachment can be procured from implement-dealers. The undercut furrow-slice obtained by using one of these attachments packs well, and covers roughage effectively.

DOG WITH DISCHARGE FROM EAR.

“CANKER,” Kai Iwi :—

I have a young dog with a continual discharge from one ear, and would be pleased for any information regarding treatment.

The Live-stock Division :—

We advise you to give the dog a good dose of opening medicine. See that his bowels are kept relaxed, and feed on light easily digested food such as well-boiled sheep-paunch, with bread or vegetables in the soup. Thoroughly clean out the ear with warm water to which has been added a small piece of washing-soda—say, a piece the size of a pea in an egg-cup of warm water. Twist up a piece of cotton-wool on a hairpin and clean out the ear with it, being very careful not to injure the lining of the ear.

FEEDING BREWERS' GRAINS.

G. ARMSTRONG, Cobden :—

Having a quantity of brewers' grains on hand, I am desirous of knowing the feeding-value of same. Are they suitable to feed cows and pigs on?

The Live-stock Division :—

Brewers' grains are quite suitable as a food for cattle and pigs if mixed with other foodstuffs. They have the property of increasing the milk-flow of cows, but they tend to decrease the proportion of solids in the milk. They are also useful for fattening purposes. It is not desirable to use grains over a long period, as they tend to cause digestive trouble. If the animals are hand-fed, about half a bushel twice daily mixed with other foods is about the proper ration for a full-grown cow.

PROPAGATING THE LAUREL.

R. SMITH, Cromwell :—

Could you inform me if it be possible to raise laurel-bushes from cuttings taken from the trees; and, if so, which is the best method of raising same, and when? For a trimmed hedge what distance should there be between each plant?

The Horticulture Division :—

The usual way of propagating the common hedge-laurel is by cuttings. It is customary to cut back a strong-growing hedge in early winter and make the cuttings (about 9 in. long) from the well-ripened annual wood. Plant them out in a nursery bed in a shady situation, with about two-thirds their length in the ground, till they root. Afterwards they can be planted out in permanent quarters at a distance of 2 ft. apart.

HORSE WITH WORMS.

"CLYDESDALE," Lumsden :—

I have a young draught horse in work which occasionally passes a white worm (4 in. long by $\frac{3}{8}$ in. thick) in his dung. He keeps in poor condition, although fed plenty of good oat-chaff and worked little. Kindly inform me as to what treatment is necessary.

The Live-stock Division :—

We would recommend you to give the horse a drench of a pint of raw linseed-oil with two tablespoonfuls of turpentine. A week later give one tablespoonful of turpentine in a pint of milk.

LAMENESS IN PONY.

"PONY," Mangamingi :—

Some six months ago a pony I was riding on the hills went lame on one hind leg. There was nothing to show except a slight puffiness at the back of the leg just above the fetlock. She has been turned out since, but is still a little lame and a little swollen about the fetlock. Would this indicate a torn sinew? Would putting a blister on it be any good?

The Live-stock Division :—

This appears to be a windgall. Cases treated at once will often respond to a pressure bandage and cold-water applications. As this case is of six months' standing, it would be advisable to blister the part well, a fly blister being the most suitable. A shoe with a fairly high heel will take the strain off the parts. After the blister has worked out, apply cold water for an hour or two daily for ten days.

KILLING POPLAR-TREES.

C. A. CROFT, Amberley :—

Would you kindly advise me as to the quickest and cheapest method of killing poplar-trees while standing?

The Horticulture Division :—

To dispose of standing poplar-trees, bore two or three auger-holes into the lower part of the trunk of each tree in a sloping direction, fill them within an inch or so of the top with commercial sulphuric acid or weed-killer, and plug them up. This operation is best carried out about midsummer, or trouble is likely to be caused by the roots suckering.

DISPOSING OF CARCASSES.

T. A. H., Te Poi, Matamata :—

Please advise me how to profitably make use of a carcass. When, say, a horse dies, to bury it is a dead loss. If a carcass is well sprinkled over with quicklime and then covered over with, say, two or three times its weight of earth, and after a time the whole mass well mixed together, will the good of the carcass be in this earth so that it could be used? Or would the action of the lime burn all the good out of the carcass?

The Live-stock Division :—

The method proposed by you of disposing of carcasses is to be condemned—firstly, on account of the grave risk of spreading disease to other animals, and, secondly, owing to the probability of its creating a public nuisance. Even if it were safe to dispose of carcasses as suggested by you, a considerable amount of the manurial value would be lost in the process. A considerable amount of the nitrates would be given off in decomposition; the lime would drive off the ammonia; and the phosphates and lime contained in the bones would be lost on account of their not being ground. If a carcass cannot be disposed of to a boiling-down works, where the most can be made from it, the safest and most economic method is to have it properly buried.

PHORMIUM AND LIVE-STOCK.

J. HENDERSON, Riverhead :—

I would like to know the relative value of chaffed flax (*Phormium tenax*) as a food for horses and cows.

The Live-stock Division :—

We know of no feeding-experiment having been carried out with the phormium-plant, and the only observations noted have been some deaths among a few cattle due to the accumulation of fibre. The material has also been known to cause severe scouring in horses.

British Market for Peas and Beans.—The following advice was cabled by the High Commissioner, London, on 1st November: *Peas*—Blue: Tasmanian "A" grade on passage sold at £21 c.i.f.; ex store quoted up to £22 per ton. Japanese market strong between £25 and £26 c.i.f. New Zealand No. 1 Partridge on passage offered for resale at 74s. to 76s. 6d. per 504 lb.; ex store, 70s. to 78s.; November-December shipment, 72s. 6d. c.i.f., nominal value. Tasmanian maple "A" sold on passage 76s. 6d.; November-December shipments, 78s. c.i.f.; very little spot trade, and quotations 82s. to 87s. 6d. *Beans*: English best winter, 52s. to 59s. per 532 lb.; spring up to 64s.; small business. Chinese horse offered at £11 per ton ex ship. Sales have been made afloat at Glasgow at £10 7s. 6d. and Liverpool £10 17s. 6d. per ton c.i.f.

WEATHER RECORDS: OCTOBER, 1924.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather during October was on the whole dull, warm, and mild. It was remarkable for the end of the dry period which had been experienced, particularly on the east coast of the South Island. Warm rains occurred several times during the month, but snow fell on the higher levels on more than one occasion, particularly in the rear of the storm which was experienced about the 20th, when barometric pressure was very low, especially in the east coast of the North Island. Another storm was experienced at the end of the month in the same parts, when, however, the barometer was over an inch higher. Atmospheric conditions were very unsettled throughout the month, and the barometer unsteady. There were six areas of westerly low pressure and at least four ex-tropical disturbances, bringing changes in the weather. On only one or two days during the month was it fine throughout the whole Dominion, one part or another being subject to unsettled and showery weather. Rainfall was above the average in most parts, exceptions being chiefly in Otago and the Bay of Plenty. Northerly to westerly winds predominated.

—D. C. Bates, Director.

RAINFALL FOR OCTOBER, 1924, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
<i>North Island.</i>				
	Inches.		Inches.	Inches.
Kaitaia	4.94	17	0.96	4.48
Russell	4.34	15	0.87	3.27
Whangarei	6.17	17	0.96	4.58
Auckland	5.67	20	1.12	3.63
Hamilton	5.56	23	0.86	4.82
Kawhia	6.54	20	1.50	5.28
New Plymouth	6.98	21	1.78	5.47
Inglewood	11.58	22	1.86	10.37
Whangamomona	7.90	17	1.04	9.11
Tairua, Thames	6.72	18	1.52	6.89
Tauranga	4.52	19	1.24	5.31
Maraehako Station, Opotiki	6.12	15	1.74	5.50
Gisborne	3.54	11	0.62	2.84
Taupo	6.30	14	2.04	4.28
Napier	3.00	11	0.87	2.50
Maraekakaho Station, Hastings	7.20	16	2.85	3.09
Taihape	4.51	18	0.99	4.30
Masterton	5.43	16	1.59	3.34
Patea	5.40	18	1.50	4.11
Wanganui	3.39	12	1.00	3.65
Foxton	3.56	9	1.80	3.03
Wellington	4.56	15	1.46	4.12
<i>South Island.</i>				
Westport	10.07	22	2.38	6.97
Greymouth	11.11	22	1.66	10.66
Hokitika	15.24	22	2.82	11.88
Arthur's Pass	15.41	19	2.38	20.99
Okuru, Westland	21.32	19	3.10	15.37
Collingwood	7.97	21	1.20	11.03
Nelson	6.71	17	1.44	3.48
Spring Creek, Blenheim	6.28	12	2.48	2.39

RAINFALL FOR OCTOBER, 1924—continued.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
<i>South Island—continued.</i>				
	Inches.		Inches.	Inches.
Tophouse	7.25	19	1.79	5.80
Hanmer Springs	6.76	14	2.06	2.66
Highfield, Waiau	6.36	12	1.90	2.46
Gore Bay	4.36	10	1.65	1.80
Christchurch	3.78	15	1.25	1.65
Timaru	4.02	14	1.14	1.97
Lambrook Station, Fairlie	4.46	12	1.78	2.00
Benmore Station, Omarama	3.14	14	0.84	2.09
Oamaru	3.63	15	0.98	1.66
Queenstown	2.66	14	0.85	3.60
Clyde	2.39	10	0.58	1.58
Dunedin	..	..	..	3.03
Gore	2.07	15	0.98	3.35
Invercargill	3.08	18	0.94	4.57

GRADING-POINTS FOR EXPORT BUTTER AND CHEESE.

THE following circular was issued by the Director of the Dairy Division to all dairy companies on 7th November:—

The suggestion that the minimum points for first-grade butter and cheese should be raised from 88 to 90, on the principle discussed with representatives of dairy companies during the past winter and spring, has been considered by the Hon. the Minister of Agriculture, and has received his approval.

From the 1st January, 1925, the nominal minimum will therefore be 90 points for first-grade creamery butter and factory cheese, and 88 points for whey butter.

The present 89-point quality for cheese will ultimately be recognized as the minimum quality for first grade, and will be scored 90 points by adding 1 point to the score for flavour.

After 1st January, 1925, for the remainder of this season the grading on the new basis for first grade will be so eased that butter and cheese will be classed first grade if, on the basis obtaining hitherto, they would score one-half point below the new minimum. Thus, after 1st January until the end of the season the Graders will bring into first grade (a) creamery butter which would score hitherto 89½ points, (b) factory cheese which would hitherto score 88½ points, and (c) whey butter which would hitherto score 87½ points.

The evidence received from the United Kingdom, and the general consensus of opinion amongst dairy companies, indicate that it is necessary, in the interests of the suppliers to dairy factories in New Zealand, to take action along the foregoing lines.

IMPORTATION OF FERTILIZERS: SEPTEMBER QUARTER.

FOLLOWING were the importations of fertilizers into New Zealand for the quarter ended 30th September, 1924: *Sulphate of Ammonia*: From Australia, 238 tons. *Nitrate of Soda*: Chile, 755 tons. *Basic Slag*: United Kingdom, 5,685 tons; Belgium, 1,308 tons. *Chardust*: Australia, 101 tons. *Bonedust*: Australia, 20 tons. *Guano and Rock Phosphate*: United Kingdom, 10 tons; New Caledonia, 3,968 tons; Nauru Island, 18,015 tons. *Phosphates, other*: Egypt, 3,300 tons. *Kainit*: United Kingdom, 170 tons; Germany, 225 tons; Belgium, 19 tons; France, 133 tons. *Sulphate of Potash*: United Kingdom, 35 tons; Germany, 130 tons; France, 8 tons. *Potash, other*: United Kingdom, 107 tons; Germany, 80 tons; France, 260 tons. *Sulphate of Iron*: Australia, 13 tons. *Miscellaneous*: United Kingdom, 3 tons.

TREES ALONGSIDE BOUNDARY-LINES: THE LEGAL POSITION.

IN the *Journal* for July last (page 68) was published a reply to an inquiry regarding the legal position under the Fencing Act as to a plantation put in 6 ft. from a boundary-fence. The question as to what constitutes "alongside any boundary-line" under the Act had, as far as we were then aware, not been determined. A correspondent has since drawn our attention to the case of *King v. Coker*, taken at the Magistrate's Court, Hastings, Hawke's Bay, in 1922, in which this point was covered. The judgment of Mr. R. W. Dyer, S.M., is self-explanatory, and is published for general information, as follows:—

These proceedings are taken under section 26 of the Fencing Act, 1908. The plaintiff and defendant are adjoining owners and occupiers of land in the Meeanee district. The defendant planted willows about 4 ft. from the boundary-fence for a distance of 230 ft. along the boundary, and a row of *Pinus insignis* about 18 in. from the willows, without the previous written consent of the plaintiff. The plaintiff states that the trees shade his land, that the foliage of the willows drops on his land, and that the roots of the trees exhaust the soil. The defendant states that he planted the trees as a shelter for his orchard, and that they in no way injure the plaintiff. Section 26, in so far as it relates to the present proceedings, is as follows: "No person shall, whether for the purpose of making a live fence or otherwise, plant or sow gorse or trees on or alongside any boundary line or fence without the previous written consent of the occupier of the adjoining land." And every one who commits a breach of any of the provisions of the section is liable for every such offence to a fine not exceeding £20. Subsection (4) of section 26 provides that, irrespective of any such fine, the occupier aforesaid may enter on the land and cut down, uproot, and destroy all gorse or trees, &c., planted or sown in breach of the section, and may recover the cost of so doing from the person who planted or sowed the same. I am now asked to convict the defendant for having committed a breach of this section. The defence raised is that the trees are not planted on or alongside the boundary line or fence, and that, therefore, the defendant ought not to be convicted.

It is clear that the trees are not planted on the boundary. Can it be said that they are planted "alongside" it? Section 26 has quite recently been considered both in the Supreme Court and Court of Appeal. In *Spargo v. Levesque* (1922, G.L.R. 37) it was held by Salmond, J., in the Supreme Court that the right of an occupier to enter adjoining lands and to cut down and destroy trees planted thereon in breach of section 26 of the Fencing Act, 1908, can only be exercised against the occupier who planted the trees and not against his successor in title. And by the Court of Appeal that right can only be exercised after proceedings have been taken against the person planting the trees for a breach of the section and a conviction obtained; and that the word "alongside" in section 26 must be read and construed as "contiguous to" or "closely side by side." Stringer, J., who delivered the judgment in the Court of Appeal, in dealing with the word "alongside," says: "The trees, to come within the prohibition, must be planted on or 'alongside' the boundary line or fence. What is the meaning of 'alongside'?" Having regard to the fact that the Fencing Act is concerned only with fences separating the lands of different occupiers, or, in other words, boundary-fences, we think the word 'alongside' must be read and construed as contiguous to or closely side by side. Unless this construction is adopted the word cannot be given any definite meaning at all. If a tree planted 4 ft. from the boundary were held to be planted 'alongside' the boundary, what is to be said of a tree planted 6 ft., 8 ft., or 10 ft., or more from the boundary? When the learned counsel for the appellant was asked at what distance from the boundary trees could be planted without infringing the terms of the section his answer was that it would vary according to the nature of the trees planted. It is clear, therefore, that, whatever the proper interpretation of the word 'alongside' may be, questions must arise as to whether in particular cases the trees complained of were in fact planted 'alongside' the boundary."

Mr. Scannell (for plaintiff) contends that the point actually decided by the Court of Appeal was that the right of entering on the land of an adjoining occupier and cutting down and destroying trees can only be exercised after proceedings had been taken and a conviction obtained against the person offending, and that the portion of the judgment that I have quoted is only *obiter*, and therefore not a direct ruling. Further, that the expression "closely side by side" is just as indefinite as the word "alongside," and that the Court of Appeal has purposely refrained from giving any interpretation to the word "alongside"; and that the matter remains exactly where it was before—namely, that "alongside" remains undefined. It is true, no doubt, that the remarks made on the word "alongside" were *obiter*, but I think, nevertheless, that they were intended as a judicial interpretation of what the word means as used in the section under review. The words in the statute are "on or alongside"—that is, on the boundary-line or close to it. "Contiguous to" means, as I understand it, that there is a point of contact between the trees and the boundary-line—that is to say, that the trees are touching the line. "Closely side by side" means, I think, that although the trees may not actually touch the boundary-line, they nearly do so or almost touch. If I am correct in this, I think it is clear that the trees in question are not alongside the boundary-line. The willows are about 4 ft. from the line. In the judgment in *Spargo v. Levesque* (1922, G.L.R. 37) the question is put, "If a tree planted 4 ft. from the boundary were held to be planted 'alongside' the boundary, what is to be said of a tree planted 6 ft., 8 ft., 10 ft., or more from the boundary? It seems clear from this that the Court of Appeal would hold that a tree planted 4 ft. from the boundary was not 'alongside' the line.

I think there is a good deal to be said for Mr. Lusk's contention (for defendant) that the Fencing Act deals with fencing only, and in no way interferes with the common-law rights of adjoining owners in respect of overhanging branches of trees and cognate matters. These remain the same, and are not abrogated by the statute. I think, therefore, that the summons should be dismissed, with costs, upon the ground that the trees are not planted "alongside" the boundary-line.

ESTIMATED AREAS UNDER WHEAT AND OATS.

THE following estimates of the areas under wheat and oats in the Dominion for the current season have been issued by the Government Statistician, under date 27th October, the figures being based on the usual card census: Wheat—North Island, 3,000 acres; South Island, 167,000 acres: total, 170,000 acres. Oats—North Island, 55,000 acres; South Island, 425,000 acres: total, 480,000 acres. The corresponding final totals for the previous season (1923-24) were 178,652 acres of wheat and 417,377 acres of oats. In the current season's wheat-sowings the areas under the different varieties are given as follows: Tuscan or longberry, 115,194 acres; Hunters (various), 32,210 acres; Velvet or Pearl, 13,868 acres; balance unspecified.

TICK REGULATIONS REGARDING GOATS.

ADDITIONS have been made to the regulations for the prevention of the spread of ticks (*Ixodidae*) among stock so as to include goats. Any person desiring to remove goats from Area A must first obtain a permit in the prescribed form from an Inspector, or some other person authorized by an Inspector, authorizing their removal, and such goats may thereafter leave Area A only at the place and within the time specified in such permit. If goats intended to be removed from Area A are found to be harbouring ticks a permit will not be issued unless and until such goats have been so treated as to ensure the complete destruction of all cattle-ticks upon the legs by immersion in an effective tick-destroying fluid, or by some other effective method at the discretion of the Inspector, or on the head by spraying or sponging with the same fluid. The new regulations were gazetted on 30th October, and came into force on the same date.

THE SEASON'S LAMBING: NORTH ISLAND ESTIMATE.

FROM information furnished by the Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 85 per cent. With 7,148,949 breeding-ewes in the North Island, as shown in the 1923 sheep returns, the number of lambs is estimated at 6,049,652. South Island and Dominion estimates will appear in next month's issue.

FORTHCOMING AGRICULTURAL SHOWS.

Otago A. and P. Society : Dunedin, 26th and 27th November.
 Stratford A. and P. Association : Stratford, 26th and 27th November.
 Hauraki A. and P. Association : Paeroa, 26th and 27th November.
 Wyndham A. and P. Society : Wyndham, 5th December.
 Southland A. and P. Association : Invercargill, 9th and 10th December.
 Rangitikei A. and P. Association : Taihape, 14th and 15th January.
 Woodville A. and P. Association : Woodville, 20th and 21st January.
 Waimarino A., P., H., and I. Association : Raetihi, 22nd January.
 Tapanui Farmers' Club : Jubilee Show, Tapanui, 28th January.
 Pahiatua A. and P. Association : Pahiatua, 30th January.
 Clevedon A. and P. Association : Clevedon, 7th February.
 Dannevirke A. and P. Association : Dannevirke, 11th and 12th February.
 Te Puke A. and P. Association : Te Puke, 12th February.
 Rodney Agricultural Society : Warkworth, 14th February.
 Northern Wairoa A. and P. Association : Mititai, 17th and 18th February.
 Masterton A. and P. Association : Solway, 17th and 18th February.
 West Coast A. and P. Association : Greymouth, 18th and 19th February.
 Rotorua A. and P. Association : Rotorua, 20th February.
 Waiapu P. and I. Association : Ruatorea, 25th and 26th February.
 Tauranga A. and P. Association : Tauranga, 26th February.
 Opotiki A. and P. Association : Opotiki, 26th February.
 Franklin A. and P. Association : Pukekohe, 27th and 28th February.
 Omaha and Pakiri A. and H. Association : Leigh, 28th February.
 Taumarunui A. and P. Association : Taumarunui, 4th March.
 Waikato Central A. Association : Cambridge, 4th and 5th March.
 Mangonui A. and P. Association : Mangonui, 6th and 7th March.
 Morrinsville A., P., and H. Society : Morrinsville, 11th March.
 King-country Central A. and P. Association : Te Kuiti, 12th March.
 Matamata A. and P. Association : Matamata, 19th March.
 Mayfield A. and P. Association : Mayfield, 21st March.
 Methven A. and P. Association : Methven, 26th March.
 Temuka and Geraldine A. and P. Association : Winchester, 2nd April.

Agricultural and Pastoral Association Secretaries are invited to supply dates and location of their shows for publication in this list.

Area under Potatoes.—The Government Statistician estimates the area under potatoes this season (1924-25) as 6,000 acres in the North Island and 18,000 acres in the South Island, or a total of 24,000 acres. The corresponding final figures for the 1923-24 season were 5,630, 15,363, and 20,993 acres respectively. Only holdings of 1 acre and over outside borough boundaries are covered by these figures. A fair aggregate area of potatoes is grown on the smaller holdings and within boroughs.